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Table

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Chapter Thirteen. Central China Iron and Steel Company, Ta-yeh Steel Works

I. Outline

A. Name of Enterprise

Central China Iron and Steel Company Ta-yeh Steel Works

Note: This steel works is said to have been locally referred to as the Ta-yeh Iron and Steel Works up until early 1953.

B. Form of Enterprise and Affiliation

It is a state-operated enterprise, affiliated with the Central China Iron and Steel Company which is under the Iron and Steel Industry Control Bureau of the Ministry of Heavy Industry, Central People's Government.

Note: Aside from this works, Plant No 315, the Ta-yeh Iron Mining Office and the Central China Construction Office have been established since January 1953 as affiliated enterprises of the Central China Iron and Steel Company.

C. Location and Plant Layout

1. Location: HUANG-SHIH, (STC 7806/4258), HUPEH Province — see Chart No 13-1

Note: The city of HUANG-SHIH was formed through the amalgamation of the former SHIH-HUI-YAO (30°11'N 115°07'E) and HUANG-SHIH-CHIANG (30°13'N 115°05'E) of TA-YEH Hsien.

2. Plant layout -- see Chart No 13-2

D. Types of Operations

It carries out pig-iron manufacturing, steel manufacturing, rolling, forging and casting, and the production and sale of secondary iron and steel products such as nail, rivet, and wire rods.

E. Management Structure

See Chart No 13-40

F. Type of Works

It is an enterprise engaged in the integrated process of steel manufacture concurrently manufacturing ordinary steel and special steel.

G. Principal Equipment, Itemized Production and Destination of Products

See Table No 13-1

H. Labor Force: in May 1953, about 6,000 workers

I. Various Aspects of the Plant's Location

1. The plant is located in the southern fringe of HUANG-SHIH and it occupies an area of 800,000 square meters.

2. The plant's north side adjoins the city of HUANG-SHIH, the south side borders on a hill beyond which flows the YANGTZE River, the east side faces the YANGTZE River and the west side is connected with a hilly region. The Shih-tzu-shan Iron Mine, Hsiang-pi-shan Iron Mine, O-ch'eng Iron Mine, etc are located over an area of about one to 10 kilometers northeast of the plant. The foregoing mines have abundant deposits of magnetite and hematite ores whose iron content exceeds 60 per cent.

3. Following are distances (in kilometers) from HUANG-SHIH to principal cities in Central CHINA.

a. WU-HAN (STC 2976/3352): 139

b. CHIU-CHIANG (22°49'N 113°02'E): 130

c. WU-HU (31°21'N 118°23'E): 638

d. NANKING: 732

e. SHANGHAI: 1160

f. P'ING-HSIANG (27°37'N 113°50'E): 710

4. There is no direct railroad connection at this place and water transportation on the YANGTZE River is the principal means of transportation. Within the plant site, there are two wharves (on the YANGTZE River) from where boats constantly navigate upstream to CHUNGKING and WU-HAN and downstream to NANKING, and SHANGHAI. The Yuehhan Line runs from P'ING-HSIANG, the chief supply center of coal and coke, to WU-CH'ANG (30°32'N 114°17'E) from where these raw materials (fuel) are transshipped to HUANG-SHIH by boats.

5. The basic conditions concerning the supply of raw materials, motive power, etc are generally as follows:

a. Iron ore

As mentioned previously, the Shih-tzu-shan Iron Mine, Hsiang-pi-shan Iron Mine and the O-ch'eng Iron Mine are located not too far from the plant. These mines have abundant deposits of rich ore with more than 60 per cent iron content. The mining facilities of these iron mines are now being reconstructed so that it can be regarded that iron ore will be smoothly supplied in abundance once the reconstruction of those mining facilities is completed.

Note: About 800,000 tons of iron ore stored here are being used to fulfill the plant's current need.

b. Coke

The P'ing-hsiang Coal Mine located in KIANGSI Province is the chief source of coke. There is no coke plant in TA-YEH, therefore coke manufactured at the mine is being supplied. In the future, a coke plant will probably be a necessity in TA-YEH.

c. Limestone

The former SHIH-HUI-YAO located within the city limits of HUANG-SHIH is, as its name indicates, the main producer of limestone and has an abundant deposit.

d. Manganese ore

Until May 1953, approximately 1,000 tons of manganese ore (manganese content 35 per cent), which was stocked here, was being used. After this stock is used up, Lo-p'ing (Central CHINA) manganese ore will probably be used.

e. Raw materials for special alloy

Tungsten, chromium, cobalt and vanadium ores are being shipped in from USSR though in small quantity.

f. Firebrick

Firebricks manufactured in T'ANG-SHAN, HOPEH Province were being received in May 1953. The quality was poor so that they were by no means the best raw material for the furnace. The products were transported by boats via SHANGHAI.

g. Water

The water of the YANGTZE River is used so that there is absolutely no difficulty in water supply.

h. Motive power

Since there is no coal here, this area is unsuited for the construction of a thermoelectric power plant. However, the construction of a hydroelectric power plant which is able to utilize the YANGTZE River will probably become necessary in the future.

6. At present, there is more than enough supply of labor power from districts in and around TA-YEH; therefore, it is believed that there will be no labor problem for quite some time. There were 6,000 workers (May 1953) at the Ta-yeh Iron and Steel Works. If compared with the An-shan Iron and Steel Company's conditions at the time, this works had, relatively speaking, about twice the number of surplus workers. However, the cultural level of the neighboring districts, the source of labor power, is low. Therefore, in this respect, supplying of labor power involves many problems.

7. Finished products for sale are chiefly marketed to SHANGHAI and a part is shipped to the Wu-han area. The bulk of the special steel products, however, is shipped to the distant Shen-yang area. Sale of these products is all effected according to a state plan. When a consolidated iron and steel center is materialized in the Ta-yeh area, its economic ties with the industrial area in Central-South CHINA centering around WU-HAN are certain to grow closer.

8. The following conditions can also be pointed out in reference to this plant's geographic location.

a. The plant is situated comparatively far inland and this coincides with Communist CHINA's efforts to disperse heavy industries to the interior.

b. Because this plant adjoins the great YANGTZE River, there is a strong possibility that this plant will become a good bombing target in time of war.

c. The biggest advantage is that iron ore can be locally supplied in great quantity, but the fact that there is no source of raw coal in the nearby vicinity will be the biggest shortcoming, particularly in time of emergency. During the last world war, for example, the Japanese Army had a hold on Ta-yeh district from the beginning to the end, but because the coal-supply route had been severed, the Army gave up the idea of the local production of pig iron and transferred a blast furnace to distant SHIH-CHING-SHAN.

J. History

1. In 1890 CHANG Chih-tung (STC 1728/0037/3159), the Governor-General of LIANG-HU (STC 0357/3275) during the Ch'ing Dynasty, being inspired with the name TA-YEH which means iron casting worker in Chinese, dispatched German experts to TA-YEH Hsien, HUPEH Province and had them conduct geological surveys. As a result, a huge amount of slag (iron content, 52 per cent) accumulation was discovered in an old mine. Following this discovery, the present Ta-yeh Iron Mine was discovered.

2. In 1891, CHANG Chih-tung established a government operated iron foundry in HAN-YANG with a capital of 10,000,000 tael. However, due to the government's financial difficulties, both the Han-yang Iron Foundry and the Ta-yeh Iron Mine were sold to a government merchant named SHENG Hsuan-huai (STC 4141/1357/2037) at a price of 6,000,000 tael.

3. In 1908 SHENG Hsuan-huai amalgamated the Han-yang Iron Foundry, Ta-yeh Iron Mine and the P'ing-hsiang Coal Mine and established the Han-yeh-p'ing Coal and Iron Co, Ltd.

4. During the Hsin-hai Revolution of 1911, the entire Wu-han area became a battleground and the operation of the Han-yeh-p'ing Coal and Iron Company was temporarily suspended. Restoration work was begun with the founding of the Republic of CHINA in 1912, and the operation of the Han-yang Iron Foundry, Ta-yeh Iron Mine and the P'ing-hsiang Coal Mine was resumed in 1913. At that time, plans were made to install a 450-ton blast furnace at TA-YEH, and to call this new plant the "New Ta-yeh Plant".

5. According to the initial plan, the construction of this blast furnace was to begin in 1914 and was to be fired in 1917. Due to the outbreak of World War I, however, arrival of machinery and equipment from Europe was delayed so that the construction did not begin until 1920. It was in 1922 that the furnace was finally fired. A second blast furnace (rated capacity, 450 tons) was constructed after World War I, but details on its construction, including date of completion, are not known. (The foregoing furnaces are the New Ta-yeh Plant's blast furnaces No 1 and No 2.)

6. The operation of the new Ta-yeh Plant's blast furnaces was suspended in 1926 due to a sharp drop in the price of iron following World War I, and these furnaces remained in that state until the latter part of World War II. The principal reason for this suspension of operation before World War II was the difficulties in management owing to the economic depression and that for the suspension during the war was the difficulties in obtaining raw coal because of the disruption of public peace and order.

7. Along with the Japanese Army's occupation of the Ta-yeh area in November 1938, a survey party was dispatched here by the Japan Iron Manufacturing Co, Ltd. Plans for the restoration of the mining department and an increase in its production were drawn-up and the mechanization of mining and ore loading operations and new development plans were pushed.

However, the entrie operation was suspended with the termination of war in August 1945. With the revision of the Ta-yeh operational policy in February 1945, the enterprise was reduced in size and blast furnace No 1 was dismantled in May 1945 and shipped to the Shih-ching-shan Iron Manufacturing Plant in HOPEH Province. Following this event, blast furnace No 2 was dismantled and shipped out, but it is said that the war ended during its shipment and that it was left as is on a boat at P'U-K'OU (32°06'N 118°44'E), situated on the bank of the YANGTZE River. The subsequent whereabouts of blast furnace No 2 is unknown.

8. At the war's end, the existing facilities in the Ta-yeh area were limited to equipment and machinery found at the mines and along the river bank. The principal equipment were as follows:

a. Facilities

(1) Shafts (100 m): two

(2) Winches: two 500-hp winches and two 150-hp winches

(3) Compressors (500 hp, 200 hp and 150 hp): six

(4) Loaders: five

(5) Pumps (10 hp to 150 hp): 17

(6) Crushers No 8: two

(7) Generators (3,000 kva): two

(8) Automatic inclines: 11

(9) Ore bin: 2,000-ton capacity

(10) Ore yard (open storage): 1,000,000-ton capacity

(11) Loading belt conveyor (capacity, 500 tons an hour): two

(12) Other facilities such as waterworks, guard facilities, company quarters, dormitory, hospital, and school: completely equipped

b. Machinery

(1) Boring machine, RL No 300: three

(2) Nine inch churn drill: two

(3) Steam locomotive (25-ton to 100-ton): 16

(4) Ore car (40-ton to 50-ton): 156

(5) Freight car and others: 118

(6) Ore car (one-ton capacity): 1,000

(7) Gasoline locomotive (25 hp): seven

(8) Boat (16-ton to 74-ton): six

(9) Cars and trucks: 28

9. The amount of ore stored at the war's end is as follows:

a. At the mine: 17,101 tons

b. At the river bank: 785,000 tons

c. WU-HU: 168,000 tons

d. P'U-K'OU: 20,000 tons

e. Total: 990,101 tons

10. The Ta-yeh area was taken over by the Chinese Nationalist Army after the war to whom the Japanese Army transferred all facilities intact. The Chinese Nationalist authorities newly established the "Central China Iron and Steel Co, Ltd" with its main office in HANKOW and its plant at SHIH-HUI-YAO, TA-YEH Hsien, and drew up a plan to engage in mining and the integrated process of steel manufacture. The following facilities were the principal equipment in the Central China Iron and Steel Co, Ltd Ta-yeh Plant (the present Ta-yeh Steel Works) at the time.

a. Pig-iron manufacturing plant: one small blast furnace (rated capacity, 30 tons; working volume 64 cubic meters)

b. Steel manufacturing plant

(1) One three-ton electric furnace -- top charging type, US manufacture

(2) One 1.5-ton Bessemer converter

(3) Two 4-ton cupolas

c. Forging plant: no equipment

d. Rolling mill: two 600-horsepower medium bar rolling mills

e. Press plant: one 3,000-ton press (shipped as reparations item by the Yawata Ironworks after the war's end but was not in operation at the time)

f. Machinery plant: two 5-ton cupolas, one 3-ton cupola and a few auxiliary machinery

11. The Chinese Nationalist authorities drew up a mining development plan for the Ta-yeh Iron Mine, but it was not put into practice because there was about 800,000 tons of stocked ore in the Shih-hui-yao area at the time. Rather than the development of the mine, the construction of a steel plant became urgent for carrying out an integrated process of steel manufacture. For this reason, a hydroelectric power plant (output, 25,000 kw) and a cement plant was constructed.

12. The Ta-yeh area was taken over by the Chinese Communist Army in late 1949. The Chinese Nationalist armies in SHIH-HUI-YAO and

HUANG-SHIH-CHIANG turned all facilities over to the Chinese Communist Army without resisting or destroying the facilities. However, the Chinese Nationalist forces (about one brigade) defending the Ta-yeh Iron Mine resisted stubbornly and in the course of the retreat, they buried the shafts of that mine and demolished all the principal facilities, including the transformer station. Thus, they devastated the mine and made its restoration extremely difficult.

13. The Chinese Communists adopted the management setup of the Chinese Nationalists and after renaming the plant the "Central China Iron and Steel Company Ta-yeh Steel Works", they resumed operation of the plant in early 1950 with the remaining facilities. After the Chinese Communist Army intervened in the Korean War in November 1950, the evacuation of heavy industrial facilities from the Northeast Area, near the battlefront became urgent, therefore the principal equipment and a part of the personnel of the Dairen Steel Works (see Chapter Three) were transferred to the Ta-yeh Steel Works late that year. The equipment and personnel transferred at that time are as follows:

a. Personnel: about 800 (including four Japanese)

b. Equipment: one 6-ton, one 3-ton, and one 1.5-ton electric ore furnaces; one 1,000-horsepower and two 350-horsepower rolling mills; and two 2-ton, three 1-ton and three 0.5-ton steam hammers.

As a result of this transfer, there was a sharp increase in the equipment capacity at the Ta-yeh Steel Plant.

14. In April 1951, the Chinese Communists made basic changes in the personnel and management setup of the Ta-yeh Steel Works and arranged the production and management setup as that of a state-operated enterprise. With the enforcement of the First Five-Year Plan in January 1953, an epoch-making plant expansion plan was drawn up by the Central China Iron and Steel Company and the affiliated enterprises of the company were classified into the Ta-yeh Steel Works, Plant No 315, the Ta-yeh Iron Mining Office and the Central China Construction Plant. With the former steel manufacturing department as the main body, the Ta-yeh Steel Works has been carrying on as an ordinary steel and special steel manufacturing plant. It is also possible that the works may be gradually converted into a plant specializing in the manufacture of special steel when Plant No 315 is completed. Plant No 315, which is now under construction, will carry out an integrated process of steel manufacture. The Ta-yeh Iron Mining Office is in charge of the Central China Iron and Steel Company's mining department. It is expected that the Ta-yeh Iron Mine of the old days will reappear but this time on a larger scale. The Central China Construction Plant was established as a department in charge of all these construction, rebuilding and expansion works. As far as construction work is concerned, the future appearance of the Ta-yeh iron and steel combine which is publicized as a "second AN-SHAN" entirely depends on this construction plant's future activities.

II. Pig-iron Manufacturing Department

A. Equipment

1. Layout -- see Chart No 13-4

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2. Principal equipment (blast furnace)

a. Name: Nittetsu small blast furnace

b. Type: iron band and iron jacket type

c. Quantity: one

d. Data -- see Table No 13-2

e. Capacity: rated at 30 tons; actual output: maximum daily output of 35 tons during the Chinese Nationalist period (1946 to 1949), maximum daily output of 80 tons under Chinese Communist control (1950 to the end of March 1953) -- see Table No 13-3.

f. Structure -- see Chart No 13-5

g. Life of furnace: four years in the case of low silicon pig-iron production; one and a half years in the case of ferromanganese production

Note: The high temperature which is required in the production of ferromanganese greatly shortens the life of the furnace.

h. History of its construction

This blast furnace was designed just before the war's end (1945) by HIROSE, an engineer of the Japan Iron Manufacturing Co, Ltd and its construction was begun, but it was suspended before long due to the termination of World War II. In early 1946, the Chinese Nationalist authorities decided to complete this furnace. They imported accessory equipment from the UNITED STATES, mobilized about 1,500 Chinese technicians, and under the supervision of about 20 American technicians completed the furnace in May 1946, as the latest American-type small blast furnace (including three Cowper-type hot blast stoves).

3. Accessory equipment -- see Table No 13-4

4. Increase and improvement of equipment

There has been no increase or improvement in the blast furnaces and accessory equipment since May 1946.

5. Defects of the equipment from the standpoint of capacity

Even though the present blast furnace is able to attain its maximum capacity, the fact that it is a small furnace with a working volume of a mere 64 cubic meters is its greatest shortcoming. The shortcoming in local ore-processing capacity will probably become more noticeable particularly after mining is resumed in the Ta-yeh Iron Mine.

The construction of Plant No 315 will greatly make up for the shortcoming in the capacity of this small blast furnace and this plant is believed to constitute an important part of the construction of an iron and steel combine centering around Ta-yeh area.

However, the output of this small blast furnace is not less than those of other blast furnaces of similar size in other areas of CHINA.

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B. Labor and Operational Setup

1. Number of workers

There are 189 workers. (Breakdown: one plant superintendent, one assistant superintendent, three technical staff personnel, four technicians, about 10 skilled workers, about 120 ordinary workers, and about 50 apprentice workers).

Note: Aside from the foregoing personnel, there are a very few clerical workers at the workshop.

2. Skill of workers

As a whole, the skill of the workers engaged in pig-iron manufacturing is not high. However, the workers are industrious and studious. Moreover, each workshop specializes in one particular work, thus enhancing production efficiency.

3. Operational setup and personnel distribution -- see Chart No 13-6

4. Labor condition

a. Every section (except the repair and distribution section and odd job section) operates on three work shifts. There is a total of 49 workers on one shift. A breakdown of the workers is as follows: furnace-door section -- five; furnace-front section-- 12; furnace-rear section -- 22; water-pipe section -- two; blower section -- four; and slag section -- four. The repair and distribution section and the odd-job section work only one shift during the day.

b. The plant superintendent and assistant plant superintendent have no night duties, but engineers (three) and technicians (four) work alternately at nights.

c. Eight-hour day system is in effect but the actual "portal to portal" time is much longer.

C. Operational Method

1. Operational processes -- see Chart No 13-7

2. Improvements of operational method

No improvement worthy of special mention has been made on operational method or operational techinques. However, the maximum daily output which was only 35 tons during the Chinese Nationalist period had been raised to 80 tons in March 1953 under the Chinese Communists. The chief reasons for this production increase are regarded to be as follows:

a. Good quality ores (iron content, 58 to 62 per cent) are well graded before being used.

b. The chemical composition of coke is suitable.

c. The labor control system has been improved so that excess personnel has been eliminated and good production results are being promoted.

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D. Raw Materials

1. Principal raw materials

a. Iron ore

There is still about 800,000 tons of stocked ore remaining from before the war's end. In May 1953, only rich ore (58 to 62 per cent iron content) were being hand-graded from the stock by women workers (temporarily hired) and used as raw material for pig-iron manufacturing. The present pig-iron manufacturing equipment consist of the one previously mentioned small blast furnace. Its annual pig-iron output being about 30,000 tons, approximately 50,000 tons of iron ore would be required annually and the ore stock would last another 10-and some odd years. However, once Plant No 315 is completed, this stock will be used up in no time. On the other hand, the new mining office will probably be completed about the same time and there should be no difficulties in the replenishment of raw materials.

The iron ore's shortcoming is that its sulphur and copper (0.4%) contents are too high.

In order to raise the pig-iron manufacturing efficiency, ores are strictly screened into 50-millimeter to 60-millimeter size.

The cost of iron ore was 200,000 yuan (less than 3,000 yen) per ton in May 1953.

b. Coke

There is no coke plant at the pig-iron plant, therefore coke produced at the mines is used. The chemical composition of coke according to its source is shown in Table No 13-5.

The amount of coke required annually is about 40,000 tons. The coke produced at the Ch'iu-yang Coal Mine in P'ING-HSIANG Hsien has less than 10 per cent ash content. Moreover the ash content is 30 per cent lime; therefore, there is an advantage in that there is no need to charge lime.

2. Secondary raw materials

a. Limestone

True to its name, the former SHIH-HUI-YAO, part of the city of HUANG-SHIH, is the main limestone producer with an abundant deposit. In various places, the general populace too are mining limestone on a small scale, so there is absolutely no shortage of limestone. The cost of limestone is cheap, but details are unknown. The specifications of limestone are shown in Table No 13-6.

b. Manganese ore

Until about May 1953, about 1,000 tons of manganese ore (manganese content, 35 per cent) in stock were being used, so there was no special need for its replenishment. The Lo-p'ing (Central CHINA) manganese ore will probably be used once this stock is depleted.

However, ferro-tungsten, ferro-silicon, chrome, nickle, copper and vanadium ores, the raw materials for special alloy, are imported in small quantities from the USSR.

c. Firebrick

Product of the T'ang-shan Brick Yard, located in T'ANG-SHAN, HOPEH Province, was being received in May 1953. The product was transported by vessels via SHANGHAI. The cost and amount required annually are unknown.

3. Supply and transportation of raw materials

a. Supply

As a whole, the supply of raw materials is smooth and no difficulties can be observed from operational standpoint.

b. Transportation -- see Chart No 13-8

4. Raw material blending ratio and quantity charged -- see Table No 13-7

E. Motive Power

1. Electric power

The amount of electricity required to produce one ton of foundry pig iron or open-hearth pig iron is 59 kilowatt-hours, while 164 kilowatt-hours is required for a ton of ferromanganese. Electricity is supplied by the thermoelectric power plant (output, 25,000 kilowatt) located in the Ta-yeh Steel Works.

2. Water

The amount of water required to produce one ton of foundry pig iron or open-hearth pig iron is 70 tons, and 218 tons is required for one ton of ferromanganese (manganese content 70 per cent). The YANGTZE River water is used, so there is no shortage of water.

F. Production

1. Daily production capacity

a. Low-silicon pig iron

(1) From late 1946 to late 1949: maximum, 45 tons; average, 35 tons

(2) In May 1951: maximum, 54.5 tons; average, 40 tons

(3) About February 1952: maximum, 69 tons

(4) About March 1953: maximum, 80 tons

b. Ferromanganese

(1) From late 1946 to late 1949: maximum, 25 tons; average, 20 tons

(2) About May 1951: maximum, 19.7 tons; average, 15.6 tons

(3) About February 1952: maximum,25 tons

Note: Ferromanganese was not produced in fiscal year 1953. The manganese content in ferromanganese is 60 to 70 per cent.

2. Annual production results

a. Low-silicon pig iron

(1) From late 1946 to late 1949: about 6,300 tons

(2) In 1951: about 7,200 tons

(3) In 1952: about 10,800 tons

(4) In 1953: about 30,000 tons

Note: The figures for the years up to 1952 were derived at by setting the operating rate in production of low-silicon pig iron at 180 days a year. At the time, low-silicon pig iron and ferromanganese were produced alternately every three months.

b. Ferromanganese

(1) From late 1946 to late 1949: about 3,600 tons

(2) In 1951: abut 2,880 tons

(3) In 1952: about 3,600 tons

Note: Ferromanganese was not produced in 1953. The production figures were derived at by setting the operating rate in production of ferromanganese at 180 days a year for the reason given in the preceding note.

3. Destination of products and its supply situation -- see Table No 13-1

4. Yield

a. Low-silicon pig iron: 92 per cent

b. Ferromanganese: 88 per cent

5. Specifications -- see Tables No 13-8 and No 13-9

6. Percentage of the products meeting specifications

a. Low-silicon pig iron

Normally, there is no rejection but some which are not up to standard in view of chemical composition are produced for about the first week after the type of pig iron manufactured is changed. The average is believed to be 95 per cent.

b. Ferromanganese

This is classified into grades No 1, No 2, and so on, depending on the manganese content; therefore, there is no reject.

7. Coefficient of effective utilization of equipment

a. During the Chinese Nationalist period

(1) Low-silicon pig iron: 1.8 cubic meters per ton per day

(2) Ferromanganese: four cubic meters per ton per day

b. During the Chinese Communist period

(1) In 1951

(a) Low silicon pig iron: 1.6 cubic meters per ton per day

(b) Ferromanganese: four cubic meters per ton per day

(2) In 1952

(a) Low-silicon pig iron: 0.9 cubic meters per ton per day

(b) Ferromanganese: 3.2 cubic meters per ton per day

(3) In 1953: low-silicon pig iron, 0.8 cubic meters per ton per day

8. Annual operating rate

The actual number of working days in a year was calculated to be 330 days in 1952 and 1953. Consequently, the annual operating rate is as follows:

$$330 \div 365 = 0.9 \text{ or } 90 \text{ per cent}$$

9. Number of days idle and its reasons

Major repair (requiring 70 days) is made once a year when manufacturing ferromanganese, and once (requiring 50 days) every two years when producing low-silicon pig iron and foundry pig iron. Accordingly, it can be assumed that major repairs (requiring 55 days) are made once every 1.5 years when the production of ferromanganese, low-silicon pig iron and foundry pig iron is alternated.

Sundays and holidays are not rest days, therefore the average number of rest days in a year is 35 days (or 330 working days).

10. Method of repairing and maintaining small blast furnaces

a. The small blast furnace was greatly damaged when it was being used for producing ferromanganese so that a major repair was required after the furnace was in operation for only about a year. The following paragraph is an account of the damages and repairs conducted on this furnace in July 1951.

Because this furnace was used to produce ferromanganese for one year, the furnace wall was severely corroded -- see Chart No 13-9 (A). Corrosion was particularly severe around the bosh portions below so that operation became difficult. Therefore, a major repair which consumed 70 days was made. In this repair, all of the furnace wall bricks were removed and relined. The highlight in this repair work is that the number of cooling boxes of the furnace wall at the bosh and below was doubled from 36 to 72 boxes. Its outline is shown in Chart No 13-9 (B). The purpose was to prevent excessive heating of the furnace bottom through the increase of cooling boxes, thereby prolonging the life of the blast furnace.

b. This first repair was completed in July 1951 and thereafter, foundry pig iron and low-silicon pig iron were produced. However, in December the furnace was overtaxed to increase production, especially during the movement to establish a new record, so that in December 1952 the hearth, particularly the steel plate around the slag hole below the tuyere, became red-hot and suddenly exploded, killing two or three workers. Thus, from January 1953, bricks from the hearth up to and including the bosh were removed and replaced under a 50-day plan.

c. As to blast furnace repair procedures, a repair plan was first drawn up. Then, a brick removing section, hauling section, brick processing section, and repair section were organized by responsible workers and technicians, and close liaison was maintained between the sections. In this manner emphasis was directed toward paying careful attention to eliminate even the slightest mistake on the time element in each section's work. For example, while the bricks were being removed, new bricks were readied so that inside repair could be started as soon as the old bricks were removed. Furthermore, accessory equipment such as hot-blast stoves and blowers were also repaired during the 50-day furnace repair period. Thus the policy was to repair the blast furnace and its equipment all at one time. Moreover, each section was driven to compete with other sections in reducing the number of days scheduled for the section.

11. Utilization of returned scrap

a. Discarded ingot case

Discarded ingot cases were purchased by foundries in the Wu-han and Shanghai areas. By melting these ingot cases in cupolas, they were made into low grade castings.

b. Recovered foundry pig-iron scrap

Recovered foundry pig-iron scrap were melted down in cupolas at the machinery shop of this works and made into low-grade products.

c. Recovered low-silicon pig-iron scrap

Recovered low-silicon pig-iron scrap was mixed with hot metal in cupola for use in open-hearth furnace and converter.

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III. Steel Manufacturing Department

A. History

1. In early 1946 when the steel manufacturing plant of the Ta-yeh Steel Works was reopened by the Chinese Nationalist Government, the only operable equipment in the plant was two 1.5-ton converters.

2. In late 1949, the Ta-yeh Steel Works came under Chinese Communist control. The condition of the equipment in the steel manufacturing plant remained almost the same for approximately one year.

3. In late 1950, a large number of steel manufacturing equipment was transferred here from the Dairen Steel Works.

4. With the completion of the installation of these equipment, the 15-ton open-hearth furnace and the four-ton cupola which had been under construction were added to the production line in early 1951. The steel manufacturing capacity, therefore, sharply increased.

B. Equipment

1. Layout -- see Chart No 13-10.

2. Principal equipment

a. Open-hearth furnace and accessories -- see Table No 13-10.

b. Converter and accessories -- see Table No 13-11.

c. Electric furnace and accessories -- see Table No 13-12.

d. Cupola and accessories -- see Table No 13-13.

3. Increase and improvement of equipment

a. During the period between early 1946 and late 1949, the steel manufacturing plant had the following equipment: one US-manufactured 3-ton Moore Rapid Lectromelt furnace (was not in operation until late 1949); two 1.5-ton Bessemer Converters (transferred from CHUNGKING); and two 4-ton cupolas. Moreover, a 15-ton open-hearth furnace was under construction, but it was not completed during this period.

b. In late 1950, one each of a 6-ton, 3-ton, 3-ton (TN Sic.) and 1.5-ton electric arc furnace and one 0.5-ton alloy furnace were transferred from the Dairen Steel Works.

c. In early 1951, the 15-ton open-hearth furnace was completed and one 4-ton cupola was installed.

d. In early 1952, the US manufactured Moore Rapid Lectromelt furnace (3 ton), which had heretofore not been in use, was put into operation and one 3-ton electric furnace, which had been transferred from DAIREN, was moved to the machinery shop. This brought about a considerable improvement of the equipment.

e. It is reported that, in 1954, two converters were transferred to TA-YEH from a certain place in HARBIN, Northeast Area. (People's Daily, 14 May 54).

f. On 1 Jun 54, the repair of an existing open-hearth furnace and the installation of a new open-hearth furnace were started. These actions were said to have been taken to increase production of open-hearth steel by 25 to 30 per cent and to reduce production cost by ten per cent. (People's Daily, 3 Jun 54).

4. Defects of equipment from the standpoint of capacity

A large quantity of machinery and equipment were brought in from the Dairen Steel Works, but since the power supply situation remained as it was in the past (of the 25,000-kilowatt power output, only about 10,000 kilowatts was available for the plant's own use), the steel manufacturing plant is unable to carry out full operation (especially of electric furnaces).

When the 6-ton electric furnace is being operated, the 3-ton electric furnace and the 1.5 ton electric furnace cannot be operated at the same time. This situation applies also to the 0.5-ton alloy furnace. Either the 3-ton furnace or the 1.5 ton furnace only can be utilized together with the alloy furnace. As can be seen from the above situation, the operation of electric furnaces is extremely curtailed by the shortage of electric power supply.

C. Labor and Operational Setup

1. Number of workers -- see Table No 13-14

2. Operational setup -- see Chart No 13-12

3. Personnel distribution and work assignment in the open-hearth furnace shop -- see Table No 13-15

4. Personnel distribution and work assignment in the converter shop -- see Table No 13-16

5. Personnel distribution and work assignment in the electric furnace shop -- see Table No 13-17

6. Personnel distribution and work assignment in the steel casting shop -- see Table No 13-18

7. Personnel distribution and work assignment in the alloy furnace shop

Until about May 1953, the alloy furnace shop was not operated every day and its equipment was made up only of one small furnace. For these reasons only two skilled workers and four ordinary workers were assigned to the shop and they worked under direct guidance of an electric furnace technician. Consequently, the operational organization of this shop had not been established.

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8. Supervision in various workshops

a. For technical and operational supervision, each workshop has technical and operational regulations for every type of furnaces and every product. A copy of these regulations is distributed to each worker so that he can work in accordance with the regulations. Operational regulations are prepared separately for open-hearth furnace, cupola, converter, 6-ton electric furnace, 3-ton electric furnace, 1.5-ton electric furnace, alloy furnace, and steel casting work. All technicians and workers in various shops carry these regulations in their pockets so they can refer to these regulations.

Moreover, technical operation inspectors are especially dispatched from the technical department to the steel manufacturing plant. They watch workers everywhere at all times. Moreover, they use temperature gauges and watches to see that workers are strictly following the regulations. In the event that workers produce inferior goods or cause damages to machinery and equipment due to negligence in complying with the aforementioned regulations, they will be subjected to a pay reduction.

b. In the field of production control, higher production is sought through various means such as production races and movements for surpassing production plan. The production plan for each month is decided at a production conference which is held at the end of the preceding month and efforts are being exerted to surpass the planned production through competition among various workshops. In the case of the open-hearth furnace shop, for example, each of three shifts is made to compete against each other so as to accomplish the production plan or to establish a new production record. A plaque or a flag is awarded to the winning section or workshop.

c. Sanitation control is being strictly enforced. The personnel are made to wear masks and keep the shop clean and neat.

d. The Accident Prevention Section is established within the Production Office and it constantly watches over the safety of machinery, equipment, and personnel.

e. Under the systematic guidance of section and team leaders, well organized control measures are being taken at various workshops. Moreover, with the enforcement of the responsibility system, the scope of responsibility and division of work are clearly defined. Therefore, the responsibility of individuals is immediately made known whenever one is negligent or fails in his work. Thus, action is always taken against responsible persons according to the seriousness of the case.

The general workers are spurred to produce more by various encouragement systems on the one hand, but they tend to be discouraged by the enforcements of the responsibility system on the other.

D. Operational Method

1. Operational process

a. Open-hearth process -- see Chart No 13-13

b. Converter process -- see Chart No 13-14

c. Electric furnace process -- see Chart No 13-15

2. Peculiarities of the operational processes

a. Open-hearth furnace

Once in 1951, the open-hearth furnace gas port broke down. This was due to the lack of experience in the utilization of Venturi gas ports on the part of the technicians (two men who studied in the UNITED STATES) and the men under them.

Due to such immature operational technique as well as the poor quality of refractory materials (their quality was lowered when they became soaked in water while being transported by boat from the T'ang-shan Brickyard), the refractoriness of the open-hearth furnace was very low and the furnace had to be repaired after an average of 250 heats (up to 600 heats in JAPAN).

b. Converter

In 1950 and 1951, the temperature of hot metal for converter was 1250 to 1300 degrees centigrade, blowing time for one heat was 20 to 30 minutes, and its life was 14 to 20 heats. The clay work at its top in particular very often melted away. Beginning in early 1952, low silicon pig iron began to be used in the converter to prolong the life of the furnace top. Furthermore, the time for one heat was reduced to 10 to 15 minutes by raising the hot metal temperature to 1300 to 1350 degrees centigrade. As a result, the converter's life was extended to 25 heats by April 1952 and to an average of 45 heats by August 1952.

At the same time, a spare converter stand was installed and a spare converter was always kept heated. Whenever the converter in operation had to be repaired, the resultant period of suspended operations was cut down by bringing in the spare converter by a crane for immediate operation, thus enabling a turnover of 95 heats a day with two converters. In this way, a production record of about 120 tons a day was attained around August 1952. Because of this production increase, the number of ingot molds was increased and the ingot casting yard was expanded.

c. Electric furnace

Beginning in August 1952, low-phosphorus pig iron from PEN-CH'I began to be used in place of the scrap iron, thus causing a change in the method of operation. In the new method, cold pig is first melted in a cupola, then transferred into a Bessemer converter where its carbon content is lowered to about 0.4 per cent, and then refined in an electric furnace. The result is a reduction in the refining period and an increase in productivity.

The process of manufacturing special steel in the Ta-yeh Steel Works follows "operational regulations" based on Soviet regulations governing the manufacture of special electric steel. Examples of these "operational regulations" are given in Charts No 13-16 through No 13-25.

3. Improvement in operational technique

a. Open-hearth furnace

Improvement of open-hearth furnace operating technique is not clear. While there was an unforeseen accident caused by lack of experience in the operation of Venturi gas ports as explained previously, this was something that happened in the second half of 1951. That was soon after the open-hearth furnace was built and the incident was due to the inexperience of the technicians and the workers under them. There have been no reports of such accidents since then and some improvements probably have been made in the operating technique of open-hearth furnace.

b. Converter

From the fourth quarter of 1953 until early 1954, a technical improvement plan containing five points pertaining to the operation of converters was introduced. Among them, the Soviet low-silicon blowing method based on the use of oxygen was especially emphasized. As a result, the blowing time for each converter was reduced by seven minutes and the highest record until then (average, 77 heats a day in December 1953) was improved by 30 per cent. It is also reported that a six-point technical improvement plan was carried out, operational methods were improved, and by May 1954 the state production plan for that year was exceeded by 12 per cent (People's Daily, 5 Aug 54).

c. Electric furnace

In the past, a great deal of this plant's special electric steel failed to meet the specifications. In the second half of 1953, however, the following three technical improvements were achieved through to the suggestion of a Soviet specialist named CHUIEFU*.

(1) Regulation of the mixing elements

Since chromium has the property of lowering the impact value of steel, great care was taken during operations to keep the amount of chromium at a minimum when the amount of carbon was at a maximum. As a result, the old qualitative shortcoming of the plant's products which passed inspections for chemical composition but were rejected for mechanical flaws was corrected.

(2) Discontinuation of the oxidation process

In August 1953, the oxidation process was adopted by the electric furnace shop for the production of high grade alloy steel but the quality of the products was very poor. After this process was discontinued at the suggestion of a Soviet specialist, the composition of the steel improved, the refining time was reduced by 40 minutes and the life of the furnace was lengthened.

(3) Improvement in ingot casting operations

In the past, workers painted the inside of the ingot molds, sprayed them with water and poured the molten steel into them without having them thoroughly dried or cleaned. Thus, even though the molten steel passed inspection for its chemical composition, the finished products -- that is, the ingots -- frequently did not pass inspection because of the increased carbon content. Upon the recommendations of a Soviet technician, painting and watering of ingot molds were discontinued and the steel was teemed only after the molds were thoroughly dried and cleaned. As a result, the percentage of the products meeting specifications has increased greatly. (People's Daily, 8 Aug 53 and 9 Nov 53).

E. Raw Materials

1. Principal raw materials

a. Scrap iron

There were about 3,000 tons of scrap iron in the plant in early 1950, and another 3,000 tons was received in mid-1951. Since early 1952, there has been no source of scrap iron in the Central-South China Area and procurement has become difficult. Therefore, a decision was made to leave a part of the scrap iron obtained in 1951 as raw material for the production of high-speed steel, and to use special pig iron for the production of other special steels. In late 1952, a scrap-iron supply of 3,000 tons was obtained, but this was made up of discarded weapons (such as rifles and machine guns) including live ammunition. Since there was the danger of explosions, hardly any of it could be used as raw material. Meanwhile, part of the open-hearth steel produced by the plant itself began to be used as raw materials for the production of special steel from the latter half of 1952.

b. Pig iron

Semilow-phosphorus pig iron (No 4 and No 5) is being obtained from the Pen-ch'i Iron and Steel Company. The amount obtained in 1952 was about 20,000 tons. This low-phosphorus pig iron is being used mainly as raw material for the electric furnace and some of it is being used as stock for the converters. Low-silicon pig iron and other pig iron produced by the pig-iron manufacturing plant are being used as stock for the open-hearth furnaces. The cost per ton of low-silicon pig iron is 1,300,000 to 1,500,000 yuan (equivalent to about 18,500 to 21,400 yen in Japanese currency). The specifications of pig iron to be used in open-hearth furnaces, converters and cupolas are given in Tables No 13-19 and No 13-20.

c. Molybdenum (for use in alloy furnace)

There is a stock of about 50 to 60 tons of molybdenum sulfide concentrate obtained from YANG-CHIA-CH'ENG-TZU (STC 2254/1367/1004/1311) in the Northeast Area. It is being used after it is mixed with limestone and hardened.

d. Tungsten (for use in alloy furnace)

The source of tungsten is not known but small amounts are being supplied as needed.

2. Secondary raw materials

a. Iron ore -- see under II, E, 1 and 2

b. Limestone -- see under II, E, 1 and 2

c. Manganese ore -- see under II, E, 1 and 2

d. Refractory material

Natural silica from SZECHWAN Province is being used as refractory material in the bottom, belly and tuyeres of the open-hearth furnace. Its chemical compositions are given in Table No 13-21.

e. Material for repairing furnaces

Magnesium oxide and raw dolomite are being used.

3. Supply and transportation

The supply of raw materials is generally smooth except in the case of scrap iron. Pen-ch'i low-phosphorus pig iron is being transported from MUKDEN to P'U-K'OU via TIENTSIN by train and from P'U-K'OU to HUANG-SHIH by boat. The others are as shown in Chart No 13-8.

4. Blending ratio

a. Open-hearth furnace

The ratio of principal raw materials in 1951 and 1952 was 60 per cent scrap iron to 40 per cent pig iron, but it was changed in late 1952 so that the ratio is 40 per cent scrap iron to 60 per cent pig iron.

b. Converter

The ratio at that time was 1.1 to 1.2 tons of pig iron and 0.18 to 0.26 ton of scrap iron to one ton of steel produced.

c. Electric furnace

Scrap iron comprised most of the mixture from 1951 to about early 1952, but Pen-ch'i low-phosphorus pig iron has been the main ingredient since May or June 1952.

5. Quality charged

a. Open-hearth furnace -- see Table No 13-22

b. Converter -- see Table No 13-23

c. Electric furnace -- see Table No 13-24

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6. Power and fuel

a. Power

The situation concerning electric power for operation of the electric furnaces has been explained under III, B, 4. The limited supply of electric power is one of the overall obstructions to production. Since expansion of the existing thermal power plant (output 25,000 kilowatts) of this works alone will not be a fundamental solution to this problem, it is reported that plans are being drawn up for the construction of a large new hydroelectric power plant that will utilize the waters of the YANGTZE River.

b. Fuel

Ping-hsiang coal is being used as raw material for the gas producers.

F. Production

1. Actual daily output

a. One 15-ton open-hearth furnace

(1) Daily output from 1951 to first half of 1952: maximum, 70 tons; average, 63 tons

(2) Daily output from August 1952 to first half of 1953: maximum, 90 tons; average, 82 tons

Note: The product consist of 160-kilogram steel ingots.

b. Two 1.5-ton converters

(1) Average daily output until late 1951: 50 tons (35 tappings)

(2) Average daily output in April 1952: 80 tons (50 tappings)

(3) Average daily output in August 1952: 100 tons (90 tappings)

(4) Maximum daily output in May 1953: 120 tons (95 tappings)

Note: Products consist of various kinds of steel for casting.

c. One 6-ton, one 3-ton and one 1.5-ton electric furnaces: daily output after the last half of 1952, 14.5 to 18 tons.

Note: Products consist of various kinds of special steel.

d. One alloy furnace

It is operated for about one week at a time as the occasion arises. During this time, it produces about one ton of ferroalloy.

2. Actual annual output

a. One 15-ton open-hearth furnace: approximately 15,000 tons in 1953.

b. Two 1.5-ton converters: between 24,000 tons and 30,000 tons in 1953.

c. One 6-ton, one 3-ton and one 1.5-ton electric furnaces: approximately 30,000 tons (ingots) in 1953.

Note: Judging from the electric power shortage, this output seems rather unreasonable.

3. Average yield

a. Open-hearth furnace

(1) From 1951 to first half of 1952: yield of steel was 88 per cent.

(2) In August 1952: yield of steel was 94.2 per cent; yield of steel ingot was 91.7 per cent.

b. Converter

During 1952, yield of steel (against charged pig iron) was 78 per cent and yield of steel ingot was 97.3 per cent.

c. Electric furnace

During 1952, yield of steel was 94 per cent.

d. Alloy furnace

In the case of ferromolybdenum, the net yield of molybdenum was 80 to 90 per cent. In the case of ferrotungsten, the net yield of tungsten was 90 to 92 per cent.

4. Specifications

Formerly, the specifications for finished products in the Ta-yeh Steel Works were not uniform. Moreover, both Soviet and American specifications were used. However, after 1953, they were gradually standardized under the Soviet specifications. The standardization of specifications (of finished products) was carried out first in the special steel department. The Soviet symbols for special steel and the presently used specifications for various finished products are given in Charts No 13-25 through No 13-39.

5. Percentage of products meeting specifications

a. Open-hearth furnace (when finished products are low-carbon ordinary structural steel)

Percentage of steel ingots meeting specifications was 98.2 per cent (in respect to the size, surface and composition)

b. Converters (when finished products are low-carbon ordinary structural steel)

Percentage of steel ingots meeting specifications was 99 per cent (in respect to the size, surface and composition).

c. Electric furnace (when finished products are various kinds of special steel)

Percentage of steel ingots meeting specifications in respect to surface was 99.8 per cent and percentage of steel ingots meeting specifications in heat test was 85 per cent (all steel material is tested).

Note: The inspection of these special steel ingots for qualifications was very strict. It included not only the outward appearance but also all the test steel materials are subjected to, such as the macroscopic test, microscopic test, analysis, heat test and mechanical test of a sample ingot from each heat and only those that qualified were released for forging or rolling processes. Consequently the acceptance rate was comparatively lower than that of products of the other furnaces.

6. Effective utilization coefficient of equipment

a. Effective utilization coefficient of open-hearth furnace $\left(\frac{\text{daily output}}{\text{effective hearth area}}\right)$

(1) From 1951 to first half of 1952

(a) Minimum daily output: 56 tons

(b) Maximum daily output: 70 tons

(c) Average daily output: 63 tons

(d) Effective hearth area: 13.72 square meters

(e) Effective utilization coefficient: 4.5

(2) August 1952 to first half of 1953

(a) Minimum daily output: 75 tons

(b) Maximum daily output: 90 tons

(c) Average daily output: 82 tons

(d) Effective hearth area: 13.72 m^2

(e) Effective utilization coefficient: 5.9

b. Effective utilization coefficient of converter (unknown)

(1) Until late 1951

(a) Average daily output: 50 tons (35 heats)

(b) Effective utilization coefficient ? (TN Sic.)

(2) In April 1952

(a) Average daily output: 80 tons (50 heats)

(b) Effective utilization coefficient, (?) (TN Sic)

(3) In August 1953

(a) Average daily output: 100 tons (90 heats)

(b) Effective utilization coefficient, (?) (TN Sic.)

(4) In May 1953

(a) Average daily output: 110 tons (95 heats)

(b) Effective utilization coefficient ? (TN Sic.)

c. Effective utilization coefficient of electric furnace

$$\left(\frac{\text{Average per-heat output} \times \frac{24}{\text{time required for each heat}}}{\text{Transformer capacity}} \right)$$

Note: It was impossible to calculate the utilization coefficient because the capacity of the transformer was unknown.

7. Annual operating rate $\left(\frac{\text{Actual number of days worked in a year}}{365} \right)$

a. Open-hearth furnace, June 1952 to May 1953

(1) Actual number of days worked: 183 days

(2) Operating rate: 51 per cent

b. Converter, June 1952 to May 1953

(1) Actual number of days worked: 270 days

(2) Operating rate: 73 per cent

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c. Electric furnace, June 1952 to May 1953

(1) Actual number of days worked: 250 days

(2) Operating rate: 68 per cent

8. Number of days idle and its reasons

a. Open-hearth furnace

(1) Reasons for suspension of operation

Due to lack of skill in open-hearth furnace operations and also due to poor quality of refractory materials, one cold repair (requiring at least about two days) had to be made after approximately 200 to 250 heats (approximately 40 to 50 days when steel is tapped five times a day). Consequently the furnace was put out of operation for approximately 20 days a year for cold repairs. In addition, since unexpected accidents occurred at times, the number of days the furnace is not in operation is comparable to the number of days it is in operation.

(2) Number of days not in operation

The open-hearth furnace was not in operation for approximately 180 days during the one-year period from June 1952 to May 1953.

b. Converter

(1) Reasons for suspension of operations

In 1951, the converter required one repair (however cold-repair time was reduced) after 14 to 20 heats. However, the life of the converters was gradually lengthened through the improvement of operational method so that after August 1952, the converters required one repair after an average of 45 heats. As a result, the number of days the furnace is not in operation was greatly reduced, remaining at about 90 days a year including the national holiday.

(2) Number of days not in operation

The converter was not in operation for 95 days during the one-year period from June 1952 to May 1953.

c. Electric furnace

(1) Reasons for suspension of operations

It was impossible to have the equipment in full operation because of the power shortages in the Ta-yeh area. Due to the fact that about half of the equipment was alternately kept idle and because of the days required for furnace repair (major repair), the number of days not in operation was over 100 a year.

(2) Number of days not in operation

The electric furnace was not in operation for approximately 115 days during the one year period from June 1952 to May 1953.

9. Repair and maintenance methods

a. Open-hearth furnace

(1) Hot repair

Up to about the first half of 1952, it required 15 minutes (included in the 4 hours and 23 minutes required for one heat) to make one hot repair. However, by May 1953, the time had been reduced to 8 to 10 minutes. As previously mentioned, since the refractory materials were inferior and the life of the open-hearth furnace was short, efforts were made to raise the production rate by reducing repair time through the use of a greater labor force. There is nothing unusual in the furnace repair method.

(2) Cold repair

Since the last half of 1952, a cold repair has been required after a minimum of 200 heats and a maximum of 300 heats and it took two to three days to make one repair. (Note: In JAPAN, one is required after a maximum of 600 heats.)

To effect a cold repair, efforts are being made to reduce the repair time by using abundant labor power and by making careful arrangements beforehand.

b. Converter

(1) Hot repair

In May 1953, one hot repair required three to four minutes. (Included in the 18.6 minutes required for one heat.)

(2) Cold repair

Up to late 1951, the converter required one cold repair after about 14 to 20 heats. Later, however, the operational method was gradually improved so that by April 1952 a cold repair was only required after about 25 heats and by August 1952 a cold repair was only required after about 45 heats. It took about half a day to make one cold repair. There is nothing unusual in the repair procedure.

c. Electric furnace

(1) Hot repair

In May 1953 one hot repair required about 10 minutes (included in the four hours and 40 minutes required for one heat).

(2) Cold repair (unknown)

10. Reprocessing of scrap steel

a. The recovered open-hearth steel (low-carbon steel) is charged into open-hearth furnace.

b. The recovered converter steel (low-carbon steel) is also charged into the cupola or open-hearth furnace.

c. Some of the scraps recovered during the rolling process are charged into the cupola used for malleable cast iron and the rest are charged into the open-hearth furnace or cupola which is used in conjunction with the converter.

d. The use of recovered special steel made in electric furnace is very limited. In general, recovered special-steel scrap allowed to be mixed amounts to only 30 per cent of the total charge for one heat. Furthermore, among these recovered special steel, those with high carbon and phosphorus contents such as stainless steel, high-speed steel, and spring steel cannot be mixed into the charges for production of certain types of steel. Therefore, recovered special steel of these types amounting to only 30 per cent of the total charge is mixed in the charge to produce steel varieties of lower grades.

Doc No 90225 (13) (PB)

IV. Rolling Department

A. History

1. There were no rolling mills in TA-YEH when the industrial facilities in this area were confiscated by the Chinese Nationalist Army from the Japanese Army immediately after the war's end.

2. When the industrial plants were reopened by the Chinese Nationalists in early 1946, two small rolls, each powered by 600-horsepower motors, were brought to TA-YEH from CHUNGKING to establish the basis for a rolling mill.

3. When the Ta-yeh area was brought under the control of the Chinese Communists in late 1949, the rolling mill was taken over undamaged, as was the case with the other plants.

4. In December 1950, the Chinese Communist authorities transferred one 1,000-horsepower medium roll and two 350-horsepower small rolls from the Dairen Steel Works to reinforce the rolling facilities in TA-YEH.

5. Thereafter, the three workshops for medium rolling (one 600-horsepower roll), small rolling (one 600-horsepower roll) and special steel rolling (one 350-horsepower roll) at this mill were kept in operation, and in May 1953, a large rolling mill (one 1,000-horsepower and one 350-horsepower rolls) was being constructed adjacent to the existing mill.

B. Equipment

1. Layout -- see Charts No 13-26 and No 13-27

2. Principal equipment

a. Medium bar mill

(1) Three-high medium roll: one

(2) Motor (600-horsepower): one

(3) Continuous-type heating furnace: one

(4) Billet cutting machine: one

b. Small bar mill

(1) Three-high small roll: one

(2) Motor (600-horsepower): one

(3) Continuous-type heating furnace: one

c. Special-steel rolling mill

(1) Three-high small roll: one

(2) Motor (350-horsepower): one

(3) Independent heating furnace: one

Doc No 90225 (13) (PB)

d. A large bar mill was under construction in May 1953. The principal equipments of this mill were as follows:

(1) Three-high large roll: one

(2) Three-high small roll: one

(3) Motor (1,000-horsepower): one

(4) Motor (350-horsepower): one

(5) Continuous type heating furnace: one

(6) Cutting machine: one

(7) Straightener: one

3. Improvements in equipment

a. Until early 1954, more than 60 different ways to improve the equipment and technique were proposed in the rolling department of the Ta-yeh Steel Works, based on experiences gained by the An-shan Iron and Steel Company and other enterprises, and efforts were made to automatize and mechanize the facilities. Of such efforts, the most important ones are as follows:

(1) A SEIIBAN (正 囲 盤), HANIBAN (反 囲 盤), and HANRITSUIBAN (反 立 囲 盤) were designed and installed. The SEIIBAN was installed in July 1953; the HANIBAN was installed in December 1953; and the HANRITSUIBAN was installed in February 1954. These devices were designed and installed by following the example of the rolling department of the An-shan Iron and Steel Company under the guidance of Soviet technicians.

Note: The SEIIBAN, HANIBAN and HANRITSUIBAN are "repeaters" of different types.

(2) In August 1953, an "automatic steel pusher", and a "furnace door manipulator" were installed. These machines were designed and installed collectively by the rolling mill workers under the leadership of LI Fang-hsien (STC 2621/6721/2009), an engineer at this mill. The primary purpose was to improve the auxiliary equipment of the heating furnace and to raise work efficiency. The "automatic steel pusher" is an automatic device designed to push ingots or billets into the heating furnace. The "furnace door manipulator" is a device designed to open or close the furnace door automatically.

(3) In late 1953, an automatic stamping machine was adopted. This machine was used to stamp the serial number, the name of the mill and the date of manufacture on the finished products.

b. It is reported that as a result of these improvements in the equipment, work efficiency has been raised as follows:

(1) The number of personnel required to operate a roll was cut down from 21 to about 10 or 11 (a saving of manpower equivalent to 624 to 780 workers a month)

(2) The number of hours spent on feeding and rolling were shortened to a great extent.

(3) Along with improvements made in the other equipment, the production of steel materials increased three and a half times. (People's Daily, 8 and 14 May 54)

4. Equipment balance

a. The balance between the medium roll and the small roll for processing ordinary carbon steel

Since the medium roll processes ingots (measuring 150 millimeters in thickness at the bottom and 110 millimeters at the top) into billets of 40 millimeters in thickness, a daily output of up to 200 tons is easy. However, since the small roll processes billets of 40 millimeters in thickness into rods 10 to 15 millimeters in diameter, it can produce only 45 tons a day. Moreover, the capacity of the continuous-type heating furnace for the small roll is low. Therefore, the imbalance between the medium roll and the small roll formed a bottleneck for the entire rolling mill. In order to overcome these shortcomings, the following measures were taken by May 1953.

(1) Changes were made so that two billets could be fed into the small roll at a time. Thus, the output was almost doubled.

(2) As for the insertion of billets into the continuous-type heating furnace for the small roll, a method was adopted whereby the billets were fed into the furnace immediately after the cutting. However, this method was of no avail because the heating capacity of the furnace itself was low. Thus, there was a tendency for the billets to accumulate before the small roll.

b. Small roll for processing special steel

Since this roll processes billets of 45 millimeters and 70 millimeters in thickness which have been forged at the forging plant, there is no imbalance between the forging plant and this shop. However, since there were so many different types of steel in different sizes, much time was spent in replacing and straightening the rollers for proper passes, thus often affecting production.

C. Labor and Operational Setup

1. Number of workers: 286

2. Operational setup -- see Chart No 13-28

3. Personnel distribution -- see Table No 13-40

4. Personnel distribution and work assignment -- see Table No 13-41

D. Raw Materials

1. Since the medium bar mill processes ordinary carbon steel, the size of the ingots are not specified, but normally those measuring more than 150 millimeters in thickness at the bottom, 110 millimeters across at the top and 600 millimeters in length are used. The chemical composition of the ingots is the same as that of ordinary carbon steel but in general, even those with more than 0.07 per cent phosphorus content and more than 0.06 per cent sulphur content are acceptable.

2. The small bar mill processes blooms measuring 40 millimeters across and 500 to 600 millimeters in length.

3. At the special steel rolling mill, billets 40 to 70 millimeters in thickness which have been forged and checked for surface scratches at the forging plant, were used as raw materials. Although there was no specification for billets, those with scratches were rejected.

E. Production

1. Actual output -- see Table No 13-42

2. Average yield in rolling

a. Medium bar mill

Losses occurring during the processing from ingot to billet of 40 millimeters in thickness: (loss due to heating) + (loss caused by cutting off the top and bottom) 3 per cent + 7.5 per cent = 10.5 per cent

b. Small bar mill

Losses occurring during the processing from billet of 40 millimeters in thickness to reinforcing steel of 10 to 15 millimeters in diameter: (loss due to heating) + (loss caused by cutting the bars down to the exact measurement) 2.5 per cent + 2 per cent = 4.5 per cent

Total loss after both processing is 15 per cent

Therefore, the average yield of common carbon steel materials from ingots is 85 per cent.

c. The average yield of special steel in rolling differs according to the type of steel. An example illustrating this fact is as follows:

(Billet) 40 to 70 millimeters in thickness rolled to 10 to 35 millimeters in diameter

(Average yield) special structural steel, 92.5 per cent; high speed steel, 91 per cent

3. Annual operating rate (latter half of 1952 to first half of 1953)

a. Medium bar mill: 94 per cent

b. Small bar mill: 94 per cent

c. Special steel rolling mill: unknown

4. Number of idle days in a year

a. Medium bar mill

b. Small bar mill

Both mills were idle for 20 days during the year (national holidays and power-suspension days)

V. Forging Department

A. History

1. There was no forging plant in existence when the facilities of the Ta-yeh Steel Works were seized by the Chinese Nationalist authorities immediately after the war's end.

2. The basis for a forging plant was established for the first time after an electric furnace and steam hammers (two 2-ton, three 1-ton and, three 0.5-ton) were transferred here from the Dairen Steel Works in December 1950.

3. These steam hammers have been operating since the day their installation was completed in April 1951.

4. In May 1953, the forging plant was expanded to install a five-ton steam hammer and its accessories. It is believed that this project had been completed by November 1954 at the latest.

B. Equipment

1. Layout -- see Chart No 13-29

2. Principal equipment -- see Table No 13-43

3. Accessories

a. Heating furnaces: four

b. Boilers: two (both are Lancashire boilers)

c. Annealing furnace

d. Surface scraping equipment

e. Pickling equipment

4. Increase or improvement in equipment

There is no increase or improvement of equipment worthy of mention except for those which were transferred from the Dairen Steel Works and the five-ton steel hammer which was being installed after May 1953.

5. Defects of equipment from the standpoints of capacity and layout

a. Since the heaviest equipment in May 1953 was a two-ton hammer, it was impossible to forge large ingots.

b. Due to the absence of soaking pits, it was impossible to produce good quality products.

c. Since the forging plant (including the heat treatment plant) was located far from the small bar mill, it was necessary to take complicated measures to complete the processing. For example, the forged billets were hauled to the rolling mill where they are rolled and then hauled back again to the forging plant for heat treatment.

6. Balance in equipment capacity

No particular imbalance is noticeable because the forging plant formed a part of a generally small-scale integrated process. However, since the build-up of the forging plant was insufficient in comparison to that of the steel mill, the forging plant cannot match the steel mill in productive capacity.

C. Labor and Operational Setup

1. Number of workers: 312 -- see Table No 13-44

2. Operational setup and personnel distribution -- see Table No 13-45

3. Level of workers' technical knowledge

The workers of the forging plant were those who were sent here from DAIREN together with the machinery. Many of them have more than 30 years' experience and their technical ability and level were very high. However, the technical level of the engineers and technicians who were supposed to supervise these workers was low.

D. Raw Materials

1. The principal raw material is steel ingots which is supplied from the steel mill

2. There is generally, a regular supply of raw materials, but the forging plant lacks the capacity to process the entire supply.

E. Operational Methods

1. Operational processes -- see Chart No 13-30

2. Improvement of operational processes

a. Until the first half of 1953, production capacity of the electric furnace department, forging department and heat treatment department in relation to each other was extremely out of balance. Since the processing capacity of the forging department was low compared to the amount steel ingots produced by the electric furnace department, there was a constant accumulation of raw materials at the forging plant. Moreover, since the efficiency in the annealing process at the heat treatment department was low in relation to the steel materials produced by the forging department, there was also an accumulation of raw materials in this workshop. This greatly obstructed the efficiency in production.

b. The two Soviet specialists, CHUIEFU* and CHIEKUSHAROFU* who came here in June 1953, made a survey of the actual conditions and recommended the "high-temperature charging", "high-speed heating", and "assembly line production" methods insofar as the heating furnaces in the forging department were concerned. These methods were introduced so that the work involved in the "heating of the raw material to the forging process can be performed by the assembly-line system. In short, the primary purpose was to boost the efficiency of the forging department in an epoch-making manner by inserting the steel ingots into the heating furnace in succession without allowing the furnace to cool and by forging these ingots which have been withdrawn from the furnace while they were still hot. It is reported that this resulted in a 57 to 66 per cent reduction in the heating time, in a 70 per cent increase in the continuous operating time of the hammer and in doubling the overall production capacity (The People's Daily, 9 Nov 53).

c. As for the heat treatment department, the following improvements were made:

(1) From the past, this department had spent long hours on the annealing process, the average being 88 hours and the maximum being 148 hours for a single operation. In addition, this department had used 700 kilograms of coal to process a ton of material. After making a survey of the workshop, the Soviet expert, CHIEKUSHAROFU*, pointed out irrationalities in the facilities and led the workers into repairing the annealing furnace five times. As a result, the annealing process was shortened to 26 to 30 hours and the coal consumption was brought down to 200 kilograms. But, there is no detailed information on the repair method. (People's Daily, 9 Nov 53)

In order to improve the quality of the steel products, he also recommended the annealing of pig iron by means of the scattering method. It is reported that in the past the quality of the steel products for the manufacturing of machinery had a high rejection rate. This quality of the steel product was brought up to the standard of specification required by having the workers observe the combustion inside the furnace and regulate the progress of combustion in the combustion chamber.

d. Numerous suggestions were submitted by the workers on how to improve the operating method. As an example, a sand blast was designed and brought into use to do away with the practice of using sulphuric acid in removing scale from steel materials, thus, eliminating the attendant danger. (People's Daily, 9 Nov 53, 13 May 54)

Note: 1. After World War II, sand blast has been used in JAPAN on castings but not on rolled steel. Although this machine gives an excellent finish, the machine itself is an expensive item and adds to the cost of the product. Specialists are of the opinion that this machine is probably used at TA-YEH for special steel.

2. Soviet names were transliterated from Chinese characters.

F. Production

1. Estimates of daily, monthly and annual outputs (two-ton hammer, one-ton hammer and half-ton hammer)

a. Daily output: 45 to 55 tons

b. Monthly output: 1,500 tons

c. Annual output: 18,000 tons

Note: It is believed that the output will increase tremendously when the installation of a five-ton hammer which was begun in April 1953 is completed.

2. Number of days operated annually and actual operating rate

a. Number of days operated annually: 350 days (three shifts a day with Sundays counted as work days; a part of the members of the various teams were granted two rest days in a month by rotation).

b. Actual operating rate: 95 per cent

VI. Secondary Products Department

A. Machinery plant

1. History

a. The machinery plant was already in existence when the Chinese Nationalist Government confiscated the Ta-yeh Steel Works from the Japanese after the end of the war. At that time, the principal equipment of this plant consisted of two 5-ton, one 2-ton and one 1-ton cupolas.

b. Thereafter, a 3,000-ton press was shipped to the Ta-yeh Steel Works as a reparations item from the Yawata Iron Manufacturing Co, Ltd. This press was installed in the machinery plant but was not as yet in operation in May 1953.

c. A new type of machine-tools (a total of about 70 long and short scale machine-tools) were purchased from the US during the Nationalist regime, to fully equip the machine-tool shop.

d. After Chinese Communists took control, the existing equipment were repaired, and the machinery plant became a very substantial plant.

The production of chilled-cast wheels has been carried out continuously at the wheel chill-casting shop of this machinery plant from the Chinese Nationalist period to the present.

2. Equipment

a. Plant and equipment layout -- see Charts No 13-31 and No 13-32

b. Principal equipment

(1) Hydraulic press shop: one 3,000-ton press (not operated in May 1953); two heating furnaces

(2) Boilermaking shop: 20 machine-tools

(3) Wheel chill-casting shop: two 5-ton cupolas; ten pit-type wheel annealing furnaces; one mold-drying oven

(4) Smithy: two ¼-ton air hammers; two 1/16-ton air hammers; one electric hammer; three small hammers; three heating furnaces; some forges and anvils; 20 small machine-tools

(5) Machine-tool shop: 70 long and short scale machine-tools (lathes, drilling machines and planers) -- all are new items imported from the US during Chinese Nationalist control

(6) Foundry: one 2-ton cupolas; one 1-ton cupola; one mold-drying oven; two crucible furnaces (for melting nonferrous alloys)

(7) Wood pattern and machine-work shop: some wood-pattern making machines; 20 small machine-tools

3. Labor and operational setup

a. Labor force: 657 workers

b. Operational setup of the machinery plant -- see Chart No 13-33

c. Personnel distribution in the superintendent's office of the machinery plant -- see Chart No 13-46

d. Personnel distribution in the affiliated shops

(1) Wheel chill-casting shop -- see Table No 13-47

(2) Boilermaking shop -- see Table No 13-48

(3) Machine-tool shop -- see Table No 13-49

(4) Smithy -- see Table No 13-50

(5) Foundry -- see Table No 13-51

4. Raw materials

a. Principal raw materials

(1) Hydraulic press shop

This shop was not ready for operation in May 1953. However, at that time, there was a plan to carry out the pressing process by obtaining steel materials from the steel mill.

(2) Boilermaking shop: obtains plates from the rolling mill

(3) Wheel chill-casting shop: obtains foundry pig iron from the pig-iron manufacturing plant

(4) Smithy: obtains soft steel materials from the steel mill

(5) Machine-tool shop: obtains semiprocessed goods from the wheel chill-casting plant, smithy and the foundry

(6) Foundry: obtains foundry pig iron from the pig-iron manufacturing plant

b. Raw material supply and requirements

All of these shops are operated on a small scale. Therefore, supply and demand of raw materials is comparatively smooth.

5. Operational method

Operational process

Since various types of products are produced at the machinery plant, it is difficult to summarize processing methods for all the products. The following is an outline of processing methods for special products.

(1) Chilled wheel

(Wheel chill-casting shop)

Cupola furnace ——→ teeming ——→ annealing

↑

Molding

furnace ——→ extracting and cooling ——→

(Machine-tool shop)

inspection ——→ Shearing process ——→

finished product

(2) Crankshaft

(Smithy) (Machine-tool shop)

rough forging ——→ roughing cut ——→ finishing cut ——→

finished product

6. Production

a. Daily output by the principal shops

(1) Wheel chill-casting shop

(a) From early 1946 to late 1949: 50 chilled cast wheels in one day

(b) After the latter half of 1951: 100 chilled cast wheels a day

(2) Foundry: from the latter half of 1951 to the first half of 1953, produced five tons of various types of machinery and castings a day

(3) Smithy: from the latter half of 1952 to the first half of 1953, produced 10 tons of various types of forged parts a day

b. Percentage of products meeting specifications at the wheel chill-casting shop

(1) From early 1946 to late 1949: 60 per cent

(2) After the latter half of 1951: 80 per cent

c. Distribution of products

Chilled cast wheels are sold to the railway plant in HANKOW.

B. Wire-drawing and Nail-making Plant

1. History

a. There was no wire-drawing and nail-making plant in the Ta-yeh Steel Works either when this steel works was confiscated by the Chinese Nationalist government after the war or when this steel works was placed under the control of the Chinese Communists.

b. The foundation of the wire-drawing and nail-making plant was established for the first time when a 3-ton electric furnace, wire-drawing benches, nail-making machines and screw-making machines were transferred from DAIREN in December 1950.

c. In May 1953, the wire-drawing and nail-making plant was being constructed outside the premises of the Ta-yeh Steel Works as the "Tieh-shan Plant", but this plant was not as yet ready for regular operation at that time.

2. Equipment

a. Principal equipment

(1) One 3-ton electric arc furnace (was not as yet in operation in May 1953)

(2) Some wire-drawing machines and accessory equipments

(3) About 10 nail-making machines

(4) Some screw-making machines

3. Labor and operational setup

a. Labor force

There were about 50 workers at this plant. Its breakdown is as follows: one plant superintendent, two technicians, six skilled workers and 40 apprentice workers.

b. Operational setup

This plant was not operating regularly in May 1953 and operational setup had not as yet been established.

4. Raw materials

a. Wire-drawing mill: obtains soft steel materials from the steel mill

b. Nail-making shop: obtains wire from the wire drawing mill

5. Production

a. Annual output (latter half of 1952 to first half of 1953)

(1) Piano wire: three to four tons a year

(2) Nichrome wire: one to two tons a year

(3) Soft iron wire: about 500 tons a year

(4) Nail: 100 tons a year (eight tons a month)

(5) Screw: 25 tons a year (two tons a month)

b. Distribution of products

(1) Piano wire and nichrome wire: shipped to the Shanghai area

(2) Soft iron wire: nearly all used by the Central China Iron and Steel Co, Ltd and the remainder used for making nails and screws

(3) Nails and screws: nearly all used by the Central China Iron and Steel Co, Ltd and the remainder shipped to other places

VII. Powdered Metal Alloy Plant

A. History

1. The powdered metal alloy plant was newly established when the setup of the Ta-yeh Steel Works was revised in April 1951.

2. Most of the equipment in this plant were transferred from the Dairen Steel Works in December 1950. From the time of its establishment, this plant has been operated separately from other affiliated plants as a secret plant.

B. Equipment

1. Layout -- see Chart No 13-34

2. Principal equipment -- see Chart No 13-35

3. Problems concerning equipment

Since this plant was in an experimental stage in May 1953, it is difficult to give detailed information on the capacity of equipment. However, since the capacity of equipment has been increased from that it was at the Dairen Steel Works, the plan is believed to call for the production capacity of five tons a year. However, the supply of hydrogen gas used for reduction purposes is a problem. Hydrogen gas cannot be transported from the Nanking area because there are no empty cylinders available for hydrogen gas. To solve this problem, experiments in the production of hydrogen gas through the electrolysis of water was conducted. Although the experiments were successful, it is doubtful that electrolytic equipment which can produce the required amount of hydrogen gas have been installed. Thus, it can be assumed that the operation of the powdered metal alloy plant is dependent on the establishment of a hydrogen producing plant.

C. Labor and operational setup

1. Labor force

There are 54 workers at this plant. The breakdown of the workers is as follows: one plant superintendent (technician), one assistant superintendent, seven skilled workers and 45 apprentice workers.

2. Operational setup — see Chart No 13-35

D. Operational processes

See Chart No 13-36

E. Raw materials

1. Tungsten ore: stored tungsten used as the occasion demanded

2. Cobalt: imported from the USSR .

F. Production

The actual tungsten-cobalt alloy output was about 0.5 ton in 1952. The equipment can meet a production plan calling for up to five tons a year.

VIII. Basic Construction

A. Theme of Construction

1. In early 1952 when the so-called large scale basic construction became the national theme in Communist CHINA, the plan of establishing a new iron and steel combine in Central CHINA was formed as a part of this theme. In the same year, preparations were made for the materialization of this plan and by the end of the year it materialized as the epochal expansion plan of the Central China Iron and Steel Co, Ltd.

2. It was to this end that the setup of the company was revised in early 1953. In addition to the Ta-yeh Steel Works which

heretofore had been the main plant of this company, three enterprises -- Plant No 315, the Ta-yeh Iron Mine and the Central China Construction Plant -- were decided to be established with necessary facilities.

3. The construction plan for Plant No 315 had been in the process of formulation by the Iron and Steel Industry Control Bureau of the Ministry of Heavy Industry since early 1952. At the beginning, the plan called for the construction in the Ta-yeh area of a new ironworks capable of annually producing 1,000,000 tons of pig iron and 500,000 tons of steel ingot. It is said that this plan was ratified by MAO Tse-tung on 15 Mar 52 and that the new ironworks was named Plant No 315 in commemoration of the day of ratification.

4. The construction of the Ta-yeh Iron Mining Office involved reconstruction and expansion of the former Ta-yeh mining districts with a view to self-sufficiency in iron ore after the completion of Plant No 315. Practically all of the Ta-yeh mining districts (CHIEN-SHAN, HSIANG-PI-SHAN and SHIH-TZU-SHAN) were completely destroyed when the Chinese Nationalist Army withdrew from this area in late 1949, and these mining districts were not usable. At that time the Ta-yeh Steel Works had 800,000 tons of iron ore in stock whereas its pig-iron manufacturing equipment consisted of only one small blast furnace (30-ton). Therefore, this steel works had a sufficient amount of iron ore for the time being, and the restoration work of the iron mine was not carried out until late 1952. However, as the construction of Plant No 315, whose aim was to produce 1,000,000 tons of pig iron, took concrete form in 1953, restoration and reconstruction of mining districts became an urgent and specific task.

5. The Central China Construction Plant was founded for the purpose of undertaking all of these construction projects. It is believed that this plant was established especially to undertake all the basic construction projects of the Central China Iron and Steel Co, Ltd, because the expansion project of this company was expected to be carried out on a large scale and over an extended period.

B. Principal Constructions and Their Progress

1. Plant No 315

a. Outline of the construction plan

(1) Pig-iron manufacturing department: eight 500-ton blast furnaces; four will be installed immediately

(2) Steel manufacturing department: several Anshan type open-hearth furnaces (100 to 150 tons); annual steel ingot output aimed at 500,000 tons

b. Construction progress until the end of the first half of 1953

(1) In January 1953, twenty Soviet engineers (mainly designers) settled down in the vicinity of TIEH-SHAN and began to design blast furnaces.

(2) The construction work on the worker's quarters began in April 1953 to accommodate 200,000 workers for the construction of this plant, who were then engaged in the construction work of the Huai-ho Dam.

(3) By mid-1953, the construction work had not progressed beyond the commencement of the work on the aforementioned workers' quarters, surveying of principal building sites, and leveling of the plant site.

c. Projects scheduled to be completed in 1954 and 1955

(1) Foundation work for eight 500-ton blast furnaces

(2) Foundation work for the accessories of the above furnaces

(3) Foundation work of the plant structure to house several basic open-hearth furnaces (100 to 150 tons) and foundation work of these furnaces

2. Ta-yeh Iron Mining Office

a. A transformer station was constructed in January 1953 and two 150-kva transformers were installed. For this reason, there was no difficulty in distributing power used for mine prospecting.

b. The shaft was not as yet restored in May 1953. At that time, preparation of prospecting equipment was consuming all the efforts leaving no time for the preparation of mining equipment.

c. At that time, the plan was to import all the prospecting and mining equipment from the USSR and full-scale mining operations were expected to be commenced by the time pig-iron manufacturing facilities of Plant No 315 are completed.

Note: It is said that of the mining districts of the Ta-yeh iron mines, the Chien-shan mine had been completely mined out before the end of the war. The Hsiang-pi-shan mine is said to have not been worked and have a reserve of about 100,000,000 tons (iron content 52 per cent). The Shih-tzu-shan mine reportedly still has an abundant reserve although mining was being carried out at this mining district before the end of the war. In mid-1953, test mining by means of boring was being carried out at these mines under the supervision of Soviet technicians.

3. Ta-yeh Steel Works

a. In the past, the Ta-yeh Steel Works was engaged in the integrated process of steel manufacture on a small scale. However, with the establishment of Plant No 315, it was decided that the works would produce both special steel and ordinary steel with the goal of an annual production of 100,000 tons of special steel. For this purpose, facilities were being remodeled or increased.

b. Principal projects which, in May 1953, were scheduled for completion in 1954 and 1955 are as follows:

(1) Steel manufacturing department

(a) Open-hearth furnace: two 30-ton basic open-hearth furnaces and one 30-ton acid open-hearth furnace (scheduled to be completed by mid-1954 at the latest)

(b) Electric furnace: one 3-ton electric furnace (transferred from the Dairen Steel Works) and one 0.5 ton or 1-ton alloy furnace

(2) Rolling department: one 1,000-horsepower large roll and one 600-horsepower medium roll (in the process of installation in May 1953, these rolls believed to have been installed by mid-1954 at the latest)

(3) Forging department: one 5-ton steam hammer

(4) Press processing department: one 3,000-ton press

(5) Incidental facilities department

It is believed that gas pipes, water pipes, steam pipes and electric wires have been renewed by the end of 1954 and that the water-supply facilities of the reservoir was also repaired during this period, for its capacity was previously inadequate.

c. In order to complete facilities capable of producing annually 100,000 tons of special steel, it was necessary to completely change the plant layout. For this reason, a plan was made in spring 1953 to convert the existing steel manufacturing plant into an electric furnace plant and to construct an open-hearth furnace plant on the projected steel manufacturing plant site.

Note: Annual production of up to 50,000 tons of special steel with the existing plant layout was regarded possible.

C. Various Steps in Carrying Out Construction

1. Establishment of the Construction Promotion Committee

In order to carry out planned construction smoothly, the Construction Promotion Committee for the Ta-yeh Steel Works was formed in HUANG-SHIH. YANG Jui (STC 2799/6904), secretary of the Huang-shih Municipal Committee of the Communist Party became the committee chairman, SUNG Chung-chou (STC 1350/0022/1558), acting mayor of HUANG-SHIH, was appointed assistant committee chairman, and responsible persons of the Commerce and Industry Bureau, Labor Bureau, Food Bureau and the Cooperatives in HUANG-SHIH became committee members. Liaison members were sent to WU-HAN and SHANGHAI from this committee, and these members were engaged in liaison work connected with purchase, receipt and transportation of necessary materials for construction. Also, the Transportation Bureau of HUANG-SHIH was planning to lay two railroads for the purpose of transporting construction materials and post-construction raw materials and finished products (the above is the condition in November 1953)

2. Establishment of organizations to handle constructions

The following six companies and attached plants were established as affiliates of the Central China Construction Plant.

a. Steel Mill Engineering Company

b. Rolling Mill Engineering Company

c. Machinery and Electricity Installation Company

d. Metal Assemblying Company

e. Road Maintenance and Construction Company

f. Civil Engineering Company

g. Machinery procurement station (construction machinery service station)

h. Lumber processing plant

i. Cement Mixing plant

j. Brickyard

The above conditions prevailed in January 1954

3. Dispatch of technicians to receive schooling

The Central China Iron and Steel Co, Ltd dispatched mining technicians, metallurgical technicians, electricians, and machinists to the An-shan Iron and Steel Company and the T'ai-yuan Iron and Steel Works to study new production techniques (conditions in 1953 and 1954)

D. Soviet Aid

1. It is said that the expansion and construction of the Central China Iron and Steel Company is included in the 141 Soviet aided projects in Communist CHINA.

2. In January 1953, about 20 Soviet technicians came to the construction site of this company.

3. Blast furnaces, open-hearth furnaces and their accessories to be installed here were mainly scheduled to be imported from the USSR. However, these equipment had not as yet arrived from the USSR at the end of May 1953.

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IX. Future Prospects

A. Possibility for Plant Expansion

1. The site of the basic construction projects to be carried out during the First Five-Year Plan was already defined in early 1953. Therefore, it is believed that expansion and construction will offer no problem during this period as far as the acreage of the site is concerned.

2. As previously mentioned, the eastern side of the Ta-yeh Steel Works faces the YANGTZE River and the south, west and north are surrounded by mountains, though not steep. Therefore, there is not much space for further expansion of this steel works.

B. Raw Materials

1. The greatest weakness lies in the fact that raw coal cannot be obtained locally and that there is a lack of coking facilities in the iron manufacturing areas. There is nothing that can be done in the future in reference to the source of raw coal supply. However, it is believed that the construction of the coke plant will be materialized sooner or later.

2. Another weakness is that it is difficult to obtain good firebricks. There is a possibility for refractory materials to be imported from the Chungking area in the future. Also, measures may be taken to construct a firebrick plant in this area.

C. Electric Power

The thermal power plant which was reconstructed by the Chinese Nationalists after the war's end is said to be the largest power plant in Central CHINA. This power plant is capable of generating 25,000 kilowatts of electric power. Of this amount, 10,000 kilowatts is transmitted to the Central China Iron and Steel Co, Ltd and the remaining 15,000 kilowatts is transmitted to WU-HAN. However, the various electric furnaces (6-ton, 3-ton, 1.5-ton and 0.5-ton) of the Ta-yeh Steel Works cannot be operated simultaneously with only 10,000 kilowatts of electric power; therefore, in the first half of 1953, only about half of these electric furnaces were operated every day. Consequently, power shortage must be expected to become a decisive problem once the expansion and construction of the Central China Iron and Steel Co, Ltd, are completed according to the plan. The construction of a proportionately large power plant should be carried out in keeping with the expansion and construction of this company. In mid-1953, it was rumored that a hydroelectric power plant utilizing a part of the YANGTZE River would be constructed but there was no definite plan at that time. However, some definite measures will probably be taken sooner or later concerning this problem.

D. Restoration of the Facilities on the River Bank

Ship transportation is very brisk on the YANGTZE River at the present time, and it is believed that this river will become increasingly important as the operation of this company is expanded in the future. However, most of the facilities on the river bank were either removed or destroyed after the end of the war, and loading, unloading and transportation of raw materials and finished products are presently being carried out by manpower. Demand is rising for the immediate improvement of this situation, and rehabilitation of facilities on the river bank and mechanization of loading and unloading work have been the urgent tasks of the day.

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E. Expansion of Productive Capacity

1. It is believed that the annual production capacity of special steel in the Ta-yeh Steel Works will reach 100,000 tons by the end of the First Five-Year Plan (late 1957). In this case, the special steel production capacity will be about three times that of early 1953.

2. It is believed that of the eight furnaces (rated capacity, 500 tons) scheduled to be installed at Plant No 315, four furnaces will be installed immediately. It is estimated that when these four furnaces are completed, the total annual production capacity will reach about 1,000,000 tons.

Note: Calculation was made on the assumption that the productive capacity of each furnace is 700 tons and that these furnaces are operated 360 days a year.

However, judging from the progress of the construction work, only two blast furnaces will be installed by the end of the First Five-Year Plan. In this case, the total capacity will be about 500,000 tons a year.

3. The production capacity of the open-hearth furnaces which are scheduled to be installed at Plant No 315 is aimed at 500,000 tons. The detailed plan is unknown. However, it is believed that six or seven open-hearth furnaces will be installed if they are 100-ton furnaces and about five if they are 150-ton furnaces. Judging from the progress in construction, only two of the furnaces will be completed by the end of the First Five-Year Plan. The total annual production capacity will be about 225,000 tons if two 150-ton furnaces are installed.

Note: Calculation was made on the basis of 2.5 tappings a day and 300 days of operation a year.

4. The annual output of iron ore by the Ta-yeh Iron Mining Office must reach 900,000 to 1,000,000 tons by the end of the First Five-Year Plan if iron ore is to be self-supplied and the aforementioned pig-iron manufacturing capacity is to be matched.

5. The Second Five-Year Plan is believed certain to be carried out following the completion of the First Five-Year Plan. In such case, it will not be very difficult to accomplish the expansion and construction plan of this company by the end (late 1962) of the Second Five-Year Plan, as long as no unforeseen obstacle presents itself. The production goal of 1,000,000 tons of pig iron and 500,000 tons of steel a year is also believed attainable.

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X. Management and Other Affairs

A. Changes in Managerial Structure

The Ta-yeh Steel Works is the successor to the prewar Han-yeh-p'ing Coal and Iron Company's New Ta-yeh Plant which during the war was operated as the Nittetsu Ta-yeh Ironworks. In the postwar era up to the end of the civil war, it was controlled by the Chinese Nationalists, but since 1949 it has been under the control of the Chinese Communists. After World War II, its managerial structure underwent three renovations. Managerial structures at various periods after World War II are outlined below.

1. Chinese Nationalist Era (1946 to late 1949)

a. Name of enterprise: Central China Iron and Steel Co, Ltd, Ta-yeh Plant

b. Affiliation: Chinese Nationalist Government Natural Resources Committee

c. Main office and plant

The main office was located in HAN-KOU and the plant was located in HUPEH Province, TA-YEH Hsien, SHIH-HUI-YAO. However, as the main office in HAN-KOU was nothing more than a business office, the Ta-yeh Plant formed the main body in the administration of the entire company.

d. Structure -- see Chart No 13-37

e. General Manager (person with highest authority): CHANG (STC 1728)

After the war, he was, for a short while, a manager with the Pen-ch'i Coal and Iron Company. Later, he transferred to the Central China Iron and Steel Co, Ltd to become its general manager. He remained in this capacity even after the Chinese Communists took control in late 1949 until the structural renovation of April 1951.

2. Chinese Communist Era (1950 to late 1952)

In late 1949, the entire setup of the Central China Iron and Steel Co, Ltd was taken over by the Chinese Communists. Although it was placed under the jurisdiction of the Heavy Industry Department of the Central-South China Military Administration Committee, its managerial structure and personnel remained almost the same as during the Chinese Nationalist era. However, KAO Teng-sheng (STC 7559/4583/3932), secretary of the Hankou Municipal Committee of the Communist Party, was sent as a political commissioner to TA-YEH to keep an eye on the managerial end of the entire enterprise. This setup seemed to be only a provisional measure for the early stages of rehabilitation in TA-YEH, since the matter of making sweeping changes in the managerial structure and personnel was taken up in discussion only after equipment and skilled workers from the Dairen Steel Works had been transferred to TA-YEH in late 1950. Consequently, changes along the following lines were made on 1 Apr 51.

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a. Name of enterprise: Central China Iron and Steel Company

b. Affiliation: Central-South China Military Administration Committee Heavy Industry Department

c. Main office and plant

The main office was transferred to HUANG-SHIH, the site of its plant. The plant site was the same as in the past but was now within the municipality of HUANG-SHIH which was formed through a merger of HUANG-SHIH-CHIANG and SHIH-HUI-YAO. The main office in HAN-KOU was closed, and the managerial end of the main office functions was taken over directly by the Central-South China Military Administration Committee Heavy Industry Department.

d. Key personnel

The chief of the Heavy Industry Department of the Central-South Military Administration Committee was CHU I (STC 2612/3015). General Manager of the Central China Iron and Steel Company was KAO Teng-sheng (former secretary of the Hankou Municipal Committee of the Communist Party and political commissar to the company).

There were the following six assistant managers.

(1) CHANG: in charge of managerial operations (was on company staff from Chinese Nationalist period).

(2) LI Chen-nan (STC 2621/2182/0589): in charge of steel manufacturing technique (former director of the Dairen Steel Works).

(3) YANG (STC 2799): in charge of rolling technique (former assistant director of the Dairen Steel Works)

(4) WANG (STC 3768): in charge of machinery plant.

(5) YANG: in charge of planning.

(6) WEI (STC 7614): in charge of personnel

Note: 1. The practice of installing the political commissar -- who had been dispatched by the Communist Party in the early stages of Chinese Communist seizure of an enterprise, as the general manager or senior assistant manager with the change in managerial structure and personnel that soon followed was commonly seen among other state-operated enterprises in Communist CHINA.

2. CHU I, chief of the Heavy Industry Department of the Central-South China Military Administration Committee, was an alumnus of Meiji University of JAPAN and had previously been the general manager of the Dairen Chien-hsin Company (Chinese Communist Forces arsenal). It was reported that, as the Dairen Steel Works was an affiliate of the Chien-hsin Company, his word and influence carried a great deal of weight in the transfer of the

Dairen Steel Works equipment and personnel to TA-YEH. Consequently, it is believed that assistant managers LI Chen-nan and YANG had been key personnel directly responsible to CHU I from the Dairen Steel Works days. However, it was reported that CHU I had been indicted during the Three-anti Movement in 1953 and transferred to a lesser position. It seems that he had made the mistake of placing the managerial functions under the direct jurisdiction of the Military Administration Committee Heavy Industry Department and of installing an executive during the Chinese Nationalist era as assistant manager in charge of the managerial functions.

e. Structure -- see Chart No 13-38.

3. Chinese Communist Era (From January 1953)

In January 1953, the Central China Iron and Steel Company was placed under the direct jurisdiction of the Ministry of Heavy Industry Iron and Steel Industry Control Bureau, and underwent an overall reformation as a consequence of the enterprise expansion plans that were pushed under the First Five-year Plan. The setup after the reformation was as follows:

a. Name of enterprise; Central China Iron and Steel Company

b. Affiliated enterprises: Ta-yeh Steel Works, Plant No 315 (newly constructed), Ta-yeh Iron Mining Office (newly constructed), and Central China Construction Plant (newly constructed).

c. Location of main office and affiliated enterprises

They were all located in HUANG-SHIH. However, the sales office was located in WU-CH'ANG. See Chart No 13-2 for relative locations of buildings.

d. Executives

The executives were almost the same as those during the previous era. However, detailed information on the executives for new plants are unknown.

e. Structure

The structure is briefly illustrated in Chart No 13-39. Moreover, a diagram showing the internal structure of the Ta-yeh Steel Works in April 1953 is given in Chart No 13-40.

B. Facts About Management

Details on the managerial aspects of the Ta-yeh Steel Works are unknown. The fragmentary findings obtained in the course of this survey are given below.

1. Self-supporting Accounting System

a. The Ta-yeh Steel Works is operated under the self-supporting accounting system, though the exact date of adoption is unknown. Nevertheless, it is definite that the self-supporting accounting system was not in effect in 1950. At that time, this steel works was not ready to adopt this system.

b. It is believed to have been after the structural reformation of April 1951 that this works was generally ready to adopt the self-supporting accounting system. In the latter half of 1951, a higher organ instincted the management to forward 20 per cent of the company's net profits to the Central Government. It may have been at this time, that this steel works more or less switched over to the self-supporting accounting system.

c. It was precisely from that time that rigid planning and controls were enforced in regards to production, sales and financial affairs. The person in charge of financial matters immediately began striving to speed up the turnover of capital and increase of the profit margin, and the persons in charge of the workshops began to lay emphasis on tightening controls over raw materials, boosting productivity, and lowering costs. Although distribution of the items produced here had been provided for in the sales plan designated by the Central Government, the sales department at this steel works sought the best possible market to absorb its over-productions in order to boost its sales profits by whatever amount possible.

d. It is believed that each shop or plant of this steel works is operating under the self-supporting accounting system. In other words, each department -- the pig-iron manufacturing department, steel manufacturing department, rolling department, etc -- is believed to be operated under its own self-supporting accounting system.

2. Planning system

a. About every November beginning from 1951, the Ministry of Heavy Industry Iron and Steel Industry Control Bureau has issued plans giving figures for the following year's products, production, raw materials, labor, sales, and finances. Consequently, it is believed that the practice of drafting a fiscal year plan and submitting it to the Central Government was not officially adopted until the second half of 1951.

b. However, details on the system and procedures used in the drafting of this plan are unknown.

3. Financial aspects of basic construction

a. Funds for basic construction came from the national treasury. The entire fund for construction of the Ta-yeh Iron Mining Office and Plant No 315 decided upon in January 1953, were appropriated from the national treasury. The basic construction account is kept entirely separately from the general accounts of this steel works.

b. However, construction costs involved in the partial improvement, repair and expansion of facilities are appropriated from the profits of this steel works.

4. Costs

a. Hardly any information is available on production costs or cost accounting at this steel works. However, someone who had worked here mentally estimated the overall average cost per ton for this steel works as follows:

(1) Total number of workers in late 1952: 6,000

(2) Average daily wage of each worker at that time: 11,700 yuan

(3) Average daily output of various products at that time

(a) Blast furnace products: 80 tons

(b) Open-hearth furnace products: 80 tons

(c) Converter products: 100 tons

(d) Electric furnace products: 20 tons

(e) Other products: 10 tons

(f) Total: 290 tons

(4) Manpower per ton (Item [1] ÷ Item [3]): 20.9

(5) Cost of labor per ton (Item [2] x Item [4]): 244,530 yuan

(6) Percentage of cost of labor against total cost: 30 per cent

(7) Average cost per ton of products

$$244{,}530 \div \frac{30}{100} = 815{,}100 \text{ yuan}$$

b. It is said that the ratio of raw material costs, labor costs, and administrative and miscellaneous costs which comprise the total costs of the state-operated iron and steel enterprises in Communist CHINA is 6 : 2 : 2. However, labor cost at the Ta-yeh Steel Works is comparatively high and the ratio is said to be about 5 : 3 : 2 or 6 : 3 : 1. This higher labor cost is primarily due to the necessity of using labor to haul raw materials from the pier. Raw materials shipped in by boats are unloaded on the pier and then hauled by numerous laborers to the plants where they are to be used. During the Japanese administration before the end of World War II, the raw materials were hauled by two-story cranes erected between the pier and the various shops, so the hauling cost of the raw materials was much lower. However, after the war, the cranes have been left in their damaged conditions.

c. Next, at this steel works, the ratio of manpower to production is comparatively higher than it is at other works. The number of workers per ton of material produced in the blast furnace, open-hearth furnace and electric furnace workshops is as follows:

(1) Blast furnace: three men per ton (not counting the raw material haulers)

(2) Open-hearth furnace: three men per ton (0.8 to 0.9 man per ton in JAPAN)

(3) Electric furnace: three men per ton (about two men per ton during continuous operation, but frequent suspension of operations due to electric power shortage averages it out to about three men per ton.)

The ratio of manpower to production at the aforementioned workshops is about three times that at the various furnace workshops of the An-shan Iron and Steel Company. Although there are various other special circumstances behind this situation, the maintenance of a large number of apprentices and inexperienced workers on the payroll of the Ta-yeh Steel Works can be cited as one of its underlying causes. In short, it can be concluded that the Ta-yeh Steel Works has a very low labor efficiency.

5. "Democratization" of Management

a. The Chinese Communists have been propagandizing the "democratization" of management by organizing plant control committees within various state-operated enterprises and giving workers' representatives some part in plant management. Even in this field, the Ta-yeh Steel Works has fallen behind the other works, especially those in the north.

b. In May 1953, the Ta-yeh Steel Works did not have a plant control committee. A meeting of workshop representatives was occasionally called and they performed the functions of a plant control committee.

c. It is said that this state of affairs was mainly due to the unique political environment of the Ta-yeh area. It is said that HUANG-SHIH was a mighty pro-Chinese Nationalist stronghold, and in spite of Chinese Communist efforts to stamp out this Chinese Nationalist influence since the liberation, it was still too risky to seek complete democratization of plant management in May 1953.

d. From late 1949 to late 1950, the purging of staff members and workers regarded as pro-Chinese Nationalists was almost a daily occurrence, and the persons in charge of the rolling mill and the machinery plant were also hit by this series of purges. On the whole, the penetration of Chinese Communist influence in the Central China Area and South China Area was not as rapid as it was in the Northeast Area and North China Area, and it is said that the Ta-yeh area was no exception to this trend. The granting of a greater voice in plant management to the workers under such conditions is a matter that requires considerable precaution even when considered from the standpoint of the mission of the state-operated enterprises. Although the comparatively slower progress in democratization of management at the Ta-yeh Steel Works is believed to be attributable to the lower intelligence level of the employers the aforementioned situation could also be regarded as a powerful factor.

e. The plant central committee system itself is believed to be a provisionary measure adopted after the revolution and it is said that this system is becoming only nominal throughout the country.

6. Suggestion system to promote efficiency

a. It is said that employees' suggestion review committees were set up in various workshops within the Ta-yeh Steel Works, and that they were very active and were producing good results. It is also said that due to the granting of awards (material and spiritual) for good suggestions, the system has made a favorable impression among the majority of the workers. As a consequence, an increasing number feel that "We ourselves will profit if we can promote efficiency through creative work."

b. However, a great many of the suggestions are of a very simple nature. For example, typical of this variety for which an employee was commended is the suggestion that reduced fatigue and boosted the efficiency of raw material haulers by changing the shape and length of balance poles. It is said that this committee accepted and studied all suggestions, no matter how trivial in nature, and the management always granted appropriate awards for practical suggestions.

C. Workers

1. Composition (May 1953)

a. Total number of workers is about 6,000.

b. Number of staff members and shop workers

(1) Administrative staff workers: about 200 (3.3 per cent)

(2) Technical staff workers: about 410 (6.7 per cent)

(3) Shop workers: about 5,400 (90 per cent)

c. Breakdown of technical workers

(1) Engineers: about 30

(2) Assistant engineers: about 80

(3) Technicians: about 300

Note: Twelve of the engineers have studied in the UNITED STATES.

d. Breakdown of shop workers

(1) Skilled workers: about 800 (15 per cent)

(2) Ordinary workers: about 2,800 (52 per cent)

(3) Temporary workers (apprentice): about 1,800 (33 per cent)

e. Percentage of workers by age group

(1) Under 20: about 10 per cent

(2) Between 20 and 40: about 60 per cent

(3) Between 40 and 50: 20 to 25 per cent

(4) Over 50: five to 10 per cent

f. Percentage of workers by sex

Details are unknown but women comprise about five per cent of the total personnel.

g. High ranking leaders

(1) Administrative: about 20 men (manager down to section heads)

(2) Technical: about 40 men (plant manager and engineer class)

h. Party members: about 160 men

Note: With the aim of increasing the membership to 500, screening was being carried out from April 1954.

2. Labor supply and requirement

a. Sources

(1) Aside from the 800 men who were transferred from DAIREN in late 1950, the majority of the workers come from the surrounding areas of TA-YEH and the greater half of these come from the farming villages.

(2) The 800 men transferred from the Dairen area are from the various districts of the Northeast Area.

(3) The leaders come from various places.

b. Replenishment (Up to May 1953)

(1) Ordinary workers

The replenishment of ordinary workers involves no difficulty. The Ta-yeh Steel Works was hiring so many unskilled and temporary workers from its surrounding areas at the time that it was looked upon as an unemployment relief agency. The number of applicants for jobs was always greater than the number of jobs available. The 1,800 temporary workers were hired to offset the machinery shortage in terms of manpower and were primarily engaged in transporting of raw material and products between the harbor and the workshops. This mass of workers engaged in transportation conspicuously demonstrates the low efficiency of the Ta-yeh Steel Works in the field of transportation.

(2) Skilled workers

There was none that can be regarded as skilled workers other than those transferred from DAIREN. Local replenishment of skilled workers is impossible and the works will have to await the future training of skilled workers within the works itself.

(3) Technicians

There is an abundant supply of technicians. The number of technicians sent from the Central Government is usually much greater than what has been requested. This is because the Ministry of Heavy Industry employs all of the graduates from the science and industrial colleges and distributes them to various plants. This measure seems to reflect the Government's policy of training specialists at the work sites in preparation for future operational expansion.

3. Training and education

a. Training of workers

Small groups are formed centering around an experienced skilled worker at each work site in an attempt to raise the general level of skill gradually through practical operations within the respective work shops. The training of skilled workers by this method is an established responsibility of the respective workshops.

Workers who have more than four years of continuous service are impartially recognized as skilled according to this system. However, in actuality, such workers are only capable of performing routine duties in the work shops and does not display the skill attributed to him.

Note: Seventy per cent of the workers at this works were illiterate in February 1954 (7 May 54 issue of the "People's Daily").

b. Education of supervisory personnel

In February 1954, the educational standard of 70 per cent of the leaders (all of the top, middle, and low grades) was lower than junior high school level. In an attempt to educate them, 32 off-duty training groups (mainly technical training units) have already been organized, but the results were unsatisfactory. In particular, the records of leaders transferred from other jobs and those of the workshops were bad. As a consequence, a high school for after work hours was established within the plant and at the same time 104 cultural training groups were organized mainly for the leaders with poor records, making their attendance compulsory. The number of students at the time, including the ordinary workers, shop leaders, various section heads, departmental heads, secretaries of party chapter, etc, totalled more than 4,000. (7 May 54 issue of "People's Daily")

c. Training of technicians

Training is directed chiefly at the newly employed graduates of colleges and technical schools. The college graduate receives half a year of practical training as an ordinary worker before becoming a technician step 8 (the lowest step among technicians). On the other hand, the technical school graduate receives three years of practical training as an ordinary worker before becoming a technician, step 8. In general, practical work at the workshops is emphasized in the training of technicians while closely guarding against attaching of too much importance to the theoretical phase. These trainees take their work very seriously. When engineering college graduates are assigned to workshops, they strive to thoroughly understand the theories and knowledge learned in school by practical application. They consider the workshop as an extension of the school and try to clarify vague or uncertain points at the workshops. Their basic attitude is to enlarge their own knowledge of theories through practical application by bringing into the workshops any disagreement between theory and practice and at the same time to expand the sphere of the application of theory. Moreover, such an attitude is being encouraged by the higher authorities.

d. Training of students

Each year from summer through autumn, a number of engineering students from the Wu-han, Hunan, and Nan-ch'ang universities come to the Ta-yeh Steel Works for practical training. These students are no different from the ordinary workers in that they cheerfully carry out their work by resolving their problems on livelihood and activities through meetings and by negotiating with the works' authorities on all matters through student representatives. With respect to any operating problems arising in training at the various workshops, they inquire of the worker or technician any unclear points and carefully take down notes. They bring back these notes to their quarters at night and present them for discussion, thereby, exchanging knowledges they have gained. Their motto was, "Resolve problems through practical experiences." These trainees also receive lectures on technical matters at the workshop. The lectures are adapted to the actual conditions of the workshop instead of being mere array of theories. The lectures are repeated over and over until every one of about 30 trainees fully understand the subject. Moreover, it is the duty of the lecturer to repeat them.

4. Promotion

When a worker is to be promoted to a new position, he is temporarily placed in his new position. After he has worked in that position for a certain period, his qualification is discussed at an open meeting and then the final decision is made.

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D. Working Conditions

1. Working hours

a. Shop workers

Their portal to portal time is 10 hours (actual working hours is eight hours) but an additional one half to one hour is spent in studies.

b. Office workers

Their portal to portal time is nine hours (actual working hours is eight). In addition to this, one or two hours is spent in studies.

2. Shifts

The three-shift system is in effect in the pig-iron manufacturing plant, the steel manufacturing plant, the rolling mill, and the forging shop.

3. Number of working days and rate of attendance

a. There are 26 working days in a month.

b. Attendance rate is 93 per cent. (This is the average, derived from statistics compiled in April 1954, for the preceding one year.)

4. Holidays

In general, the holidays consist of Sundays and national holidays but many turn out for work on these days at the workshops.

5. Early attendance and overtime work

These are commonly practiced but statistics are unavailable.

E. Wages and Welfare Facilities

1. Wage system (May 1953)

With respect to the wage system and its enforcement at the Ta-yeh Steel Works, only the part relating to those in the technical field and in the workshops has been somewhat ascertained.

a. Wage system according to job classification

(1) The workers in the workshops and the technical field are divided into four occupational ranks; namely engineers, technicians, assistant technicians, and workers. Their wages are determined and paid according to the following grades and steps:

(a) Engineers

They are divided into three grades and each grade is subdivided into four steps.

(b) Technicians

They are divided into step one to step eight.

(c) Assistant technicians

They are divided into step one to step four.

(d) Workers

They are divided into step one to step eight.

(2) The wages of 1st grade, step one, is the highest and the 3rd grade, step four, is the lowest for an engineer. With the technicians and assistant technicians, step one commands the highest pay and retrogressively on down in steps. Contrary to the above, step eight of the ordinary worker commands the highest wages and retrogressively down to step one.

(3) The wages of the various jobs and their respective grades have the standardized differences as expressed in Chart No 13-41. In other words, the wages of the engineer grade one, step two and the engineer, grade two, step one are the same. Also, the wages of step eight technicians, step two assistant technicians and step four worker are the same.

(4) Details regarding the criterion used in determining the wages in grades and steps are not known but the following facts have been established.

(a) First grade engineer: an engineer who is skilled in all techniques used in all the plants of this works.

(b) Second grade engineer: an engineer who is skilled in all techniques used in one certain plant of this works.

(c) Third grade engineer: an engineer who is skilled in all techniques used in a certain workshop of a plant of this works.

(d) Step eight technician: a graduate of a college of science or engineering who has spent half a year in actual work after being employed. Whether the college attended is within the country or abroad is not questioned.

(e) Step four assistant technician: a graduate of higher or technical school giving three-year course or less.

(f) Worker

In general, he has to have more than 15 years of workshop experience in order to attain the highest step (step eight). (In May 1953, there were only one or two of these workers to a workshop of about 100 workers.)

(5) Wages in the various grades and steps

The actual amount (monthly) is as follows (May 1953):

(a) Engineer, 1st grade, step two: 1,650,000 yuan

(b) Engineer, 2nd grade, step two: 1,300,000 yuan

(c) Engineer, 3rd grade, step two: 1,200,000 yuan

(d) Technician, step one: 1,100,000 yuan

(e) Technician, step eight: 450,000 yuan

(f) Worker, step eight: 800,000 yuan

(g) Worker, step one: 300,000 yuan

Note: These amounts are based on People's Note. At that time 70 yuan was equivalent to about one Japanese yen. Although the fen is being used as a unit in computing the wages at the Ta-yeh Steel Works, wages are generally mentioned not in terms of fen but in People's Notes.

b. Wage differences in jobs

The wages in the such fields of heavy labor as steel manufacturing, rolling, and forging are about a step (about 20 per cent) higher than those in the field of light labor. Other facts are unknown.

c. Method of wage payment

Details on this matter are unknown but on each pay day of the month, the office workers of the various workshops go to the financial department of the Central China Steel Company to receive the total pay of their respective shops and subsequently disburse them to the shop workers.

d. Average wages (monthly) at the Ta-yeh Steel Works

(1) Excluding temporary workers: 450,000 yuan (equivalent to about 6,470 Japanese yen)

(2) Including temporary workers: 350,000 yuan (equivalent to about 5,000 Japanese yen)

e. Deductions

Only old age insurance payment is deducted from the wages.

2. Welfare facilities (up to May 1953)

a. Labor insurance

Although an insurance system was in effect, it was not being utilized widely by workers. One of the reasons seems to have been based on the fact that the organization and activity of the workers' union which has such an important relationship to the execution of the system had not been fully developed.

b. Work safety measures

Safety measures employed at the workshop were so inadequate that for about a two-year period beginning in January 1950, there were injuries owing perhaps to unskilled operations incurred by workers daily and even to the extent of a few deaths occurring in a single day.

c. Health and medical facilities

The dispensary of the Japanese period was just about being restored at the time; therefore, preventive sanitation facilities within the works were extremely inadequate. With respect to the workers' health, there were no known commonly prevailing illnesses, but on the whole it was not good. Clinical equipment, supplies, and staff were so inadequate that it was barely possible to treat half of the patients every day. A plan to build a 100-bed hospital was discussed in May 1953 but there was no indication that construction was underway.

d. Medical expenses, child delivery expenses, etc

Workers were not subject to payment under the workers' insurance plan but due to the inadequacy of medical facilities, very few actually benefited from the plan.

e. Quarters

Workers' quarters were under construction in May 1953. Prior to their completion, ordinary workers were housed in very crowded dwellings with several families sharing a house. This was particularly evident in the case of the 800 workers from DAIREN. Contrary to promise made to them before their departure from DAIREN, practically no adequate housing facility was supplied and they were forced to lead a miserable existence. As a consequence, the relationship between these workers and the workers recruited from the local areas were not harmonious, easily giving rise to disputes and fights.

f. Nursery

There were no nurseries in May 1953. In fact, no construction plan was ever discussed.

g. Consumers' cooperatives

Consumers' cooperatives were organized and their outlets were built at a few places. However, only a few workers utilized them. As a whole, the cooperatives in the Central China Area were not adequately developed as compared to the ones in such places as the Northeast Area and the North China Area. Instead, privately-operated stores were patronized. The southern people, by nature, are tradesmen, and the business foundation that they have built over many years seems to have been impossible to upset overnight.

h. Cultural and recreational facilities

Within the plant, there is a building which serves as both the workers' clubhouse and the theater. Workers pay admission to see motion pictures. There were no theaters in HUANG-SHIH at the time.

F. Living Conditions of Workers

1. From a general standpoint, it can be said that bachelors and workers whose wives are working are leading a relatively easy life, but workers between 40 and 50 years of age who have families of many children have a difficult time.

2. The bachelor worker earning 500,000 yuans a month pays 100,000 to 130,000 yuan monthly for meals taken at the messhall. In the case of both the husband and wife, 250,000 yuan a month would suffice for food expenses. However, with a large family, food bills are five to six times more, and since there are no family allowances there are instances where the entire wages are not enough to cover the food supply for the family.

3. The wages of the office workers are far lower than those of the shop workers even though their expenses, corresponding with those of the intelligentsia, are higher than those of ordinary workers. As a result, their livelihood is generally very bad.

4. Thus the livelihoods of the employees of the Ta-yeh Steel Works differ according to the type of occupation and the kind of life led by the different individuals. In general, it can be said that a segment of the employees has definitely elevated its livelihood in comparison to what it was during the Japanese period prior to the war's end, but on the whole there is a general similarity while some have even been degraded to wretched conditions. Not a few workers are said to reminisce about the good old days.

5. The livelihood of farmers in the vicinity of the Ta-yeh Steel Works is briefly described below for reference. Their cash income in 1951 and 1952 averaged about 500,000 yuan annually, which was roughly what the lower grade workers earn in a month. Moreover, since government authorities instructed them to deposit 20 per cent of their annual income in the bank, they had a difficult time making a living. As a result, the farmers' children all aspired assiduously to be employed by the Ta-yeh Steel Works.

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G. Party Organization and Activity Within the Works

1. The organizational setup of the Chinese Communist party within the Ta-yeh Steel Works and its organizational and functional relationships to directly higher organs are shown on Chart No 13-42.

2. In May 1953, there were about 160 party members within the works. From April 1953, screening of candidate members and other progressive elements was under way for the purpose of increasing the membership to 500.

3. The party members within the works normally did not openly toe the party line among the general employees. Rather, they conducted themselves wholly in such a manner as to reflect the party policy in the management of the whole enterprise in the form of implicit guidance. However during the height of the Three-anti Movement in March 1952, they undertook to guide the masses by indicating the party's standpoint very clearly.

H. Workers' Union and Its Activities Within the Works

1. In May 1953 the workers' union within the works was not soundly organized and was not very active. Although the union did have an organizational setup, as shown in Chart No 13-43, it was not carrying out any concrete activities. Only a few party members, who were concurrently union officials, were endeavoring to strengthen the organization and develop activities. The workers, on the whole, showed very little interest in the union and made no active attempt to strengthen the union.

2. At that time the activities of the New Democratic Youth League, rather than that of the union, were increasing in vitality. Therefore, since early 1953 the party committee within the works had been following the policy of developing union activities through the New Democratic Youth League by rapidly expanding the organization of the league.

3. Moreover, the organization of the union and the League was not fully developed in the city of HUANG-SHIH as a whole.

I. Plant Security

In May 1953, the security duty of the Ta-yeh Steel Works was performed by an infantry company (about 200 soldiers) of the regular Chinese Communist army. This guard unit belonged to an organization other than the Ta-yeh Steel Works, but the manager of the works was empowered to direct the unit as need for such action arose. Moreover, a few officers of the Huang-shih Public Security Bureau wearing red arm bands were posted within the various plants of the works to settle disputes and expose irregularities. Besides these, regular army infantry troops of approximately a battalion in strength (about 1,000 men) were stationed in the entire HUANG-SHIH. Apart from this unit, there were some troops of the regular army and the public security unit stationed in the Ta-yeh mining district, but their strength is unknown.

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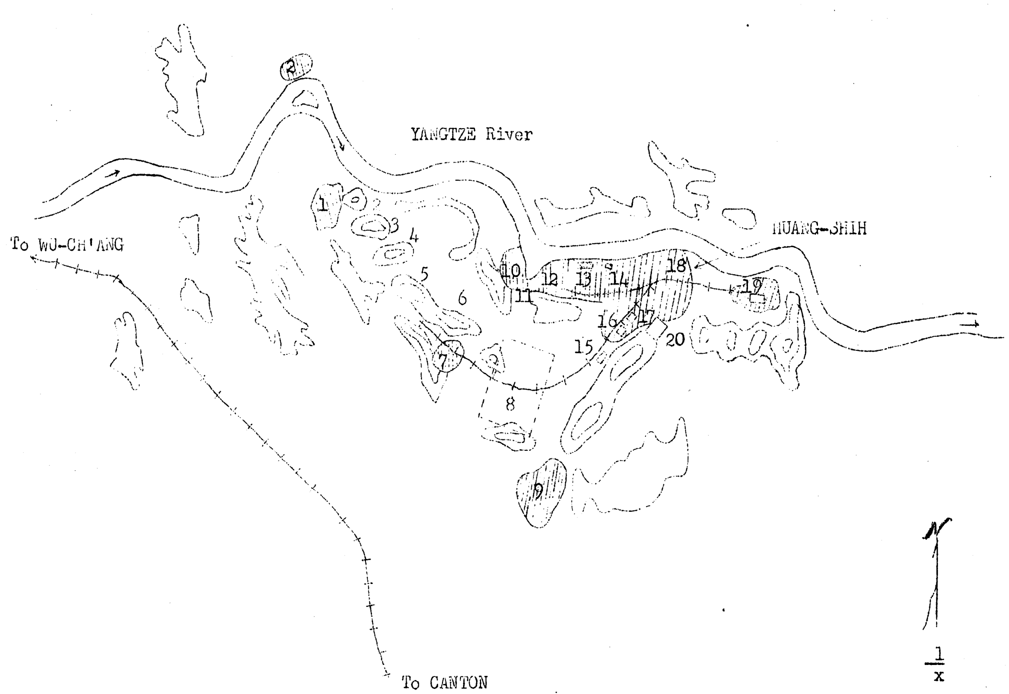
Chart No 13-1

Vicinity of HUANG-SHIH in HUPEH Province (May 1953)



Doc No 90225 (13) (PB)

Chart No 13-1 (Cont'd)

Key

1 O-CH'ENG

2 HUANG-KANG

3 O-cheng Iron Mine

4 Hsiang-pi-shan Iron Mine

5 Shih-tzu-shan Iron Mine

6 Chien-shan Iron Mine

7 TIEH-SHAN

8 Building site of Plant 315

9 TA-YEH

10 Former HUANG-SHIH-CHIANG

11 Cement Plant

12 Power Plant (25,000 kva)

13 Ore Dump (about 1,000,000 tons)

14 Iron ore loaders

15 Old locomotive shed

16 Huang-shih Municipal Government

17 Huang-shih Public Safety Bureau

18 Former SHIH-HUI-YAO

19 Ta-yeh Steel Works (including the main office of the Central China Iron and Steel Company)

20 Old limestone plant

Chart No 13-3

Traffic in Area Along the Banks of the YANGTZE River

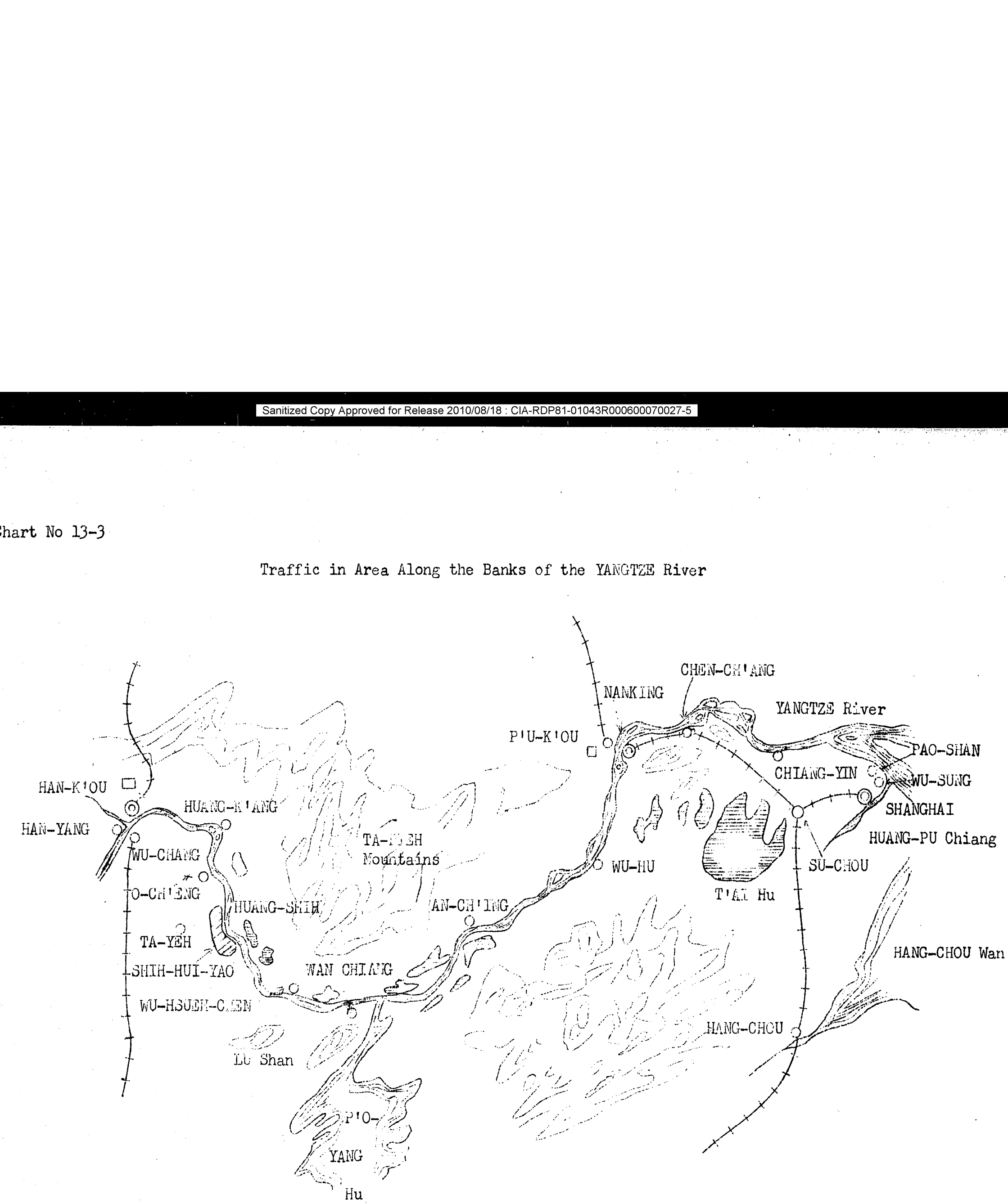


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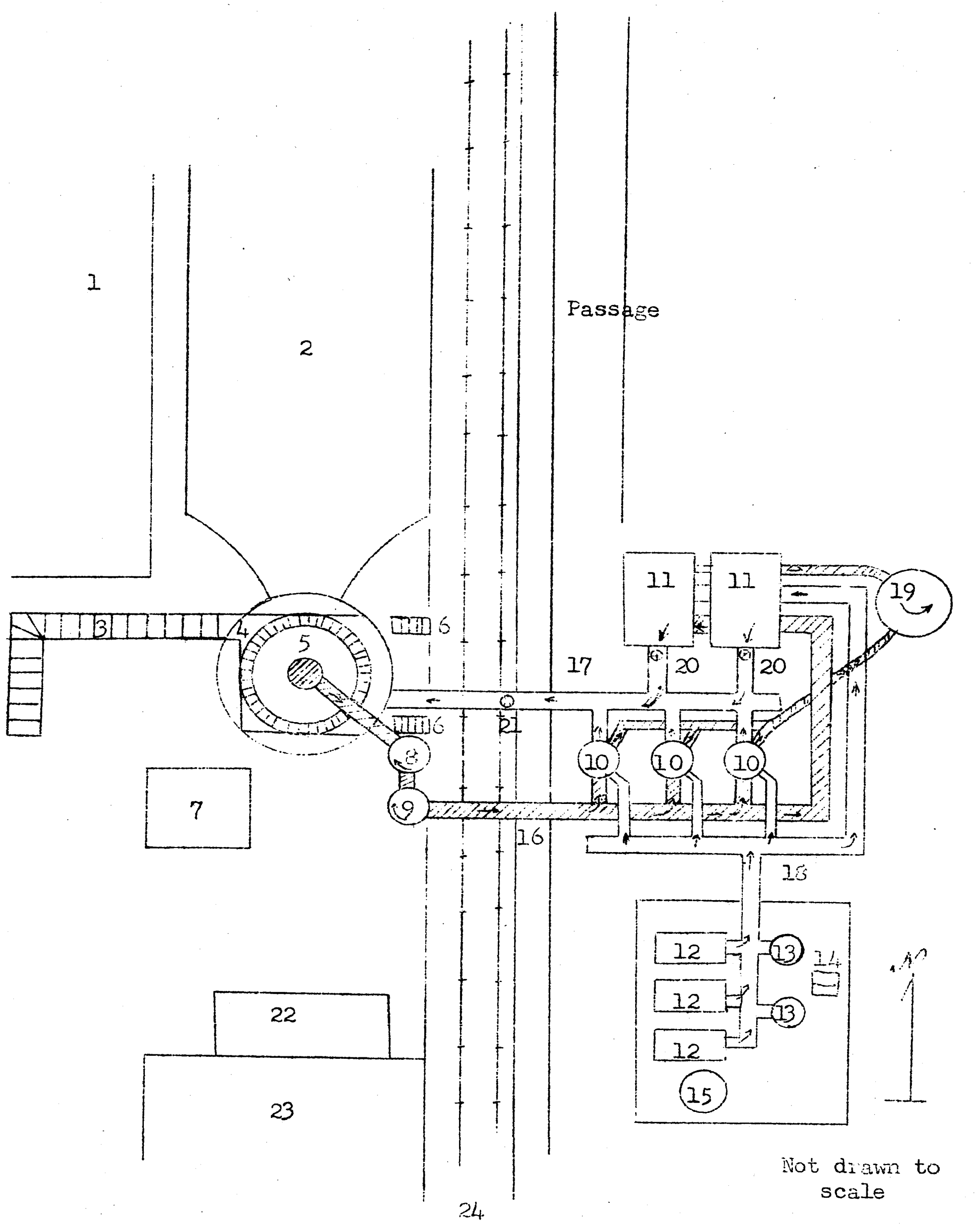
Chart No 13-4

Layout of Facilities in Pig Iron Plant



Doc No 90225 (13) (PB)

Chart No 13-4 (Cont'd)

Key

1 Iron ore, limestone, and coke (storage area)
2 Foundry
3 Charging crane
4 Charging platform
5 Blast furnace (Small; rated capacity, 30 tons)
6 Steps
7 Blast furnace control room (upstairs) (analyzing of gas and measuring of temperature)
8 Dust catcher
9 Dust washer
10 Cowper type hot-blast stoves (three)
11 Lead-tube type hot-blast stoves (two)
12 Horizontal reciprocating blowers, (three)
13 Blowers (two)
14 Electric motors, 150 hp (one)
15 Lancashire type boiler (one)
16 Blast furnace gas main
17 Hot air main
18 Cold air main
19 Waste gas flue
20 Thermometer
21 Hot air temperature gauge
22 Blast furnace office
23 Site of old 450-ton blast furnace
24 Slag-car rail

Legend

Hot (cold) air

Blast furnace gas

Doc No 90225 (13) (PB)

Chart No 13-5

Structure of Small Blast Furnace

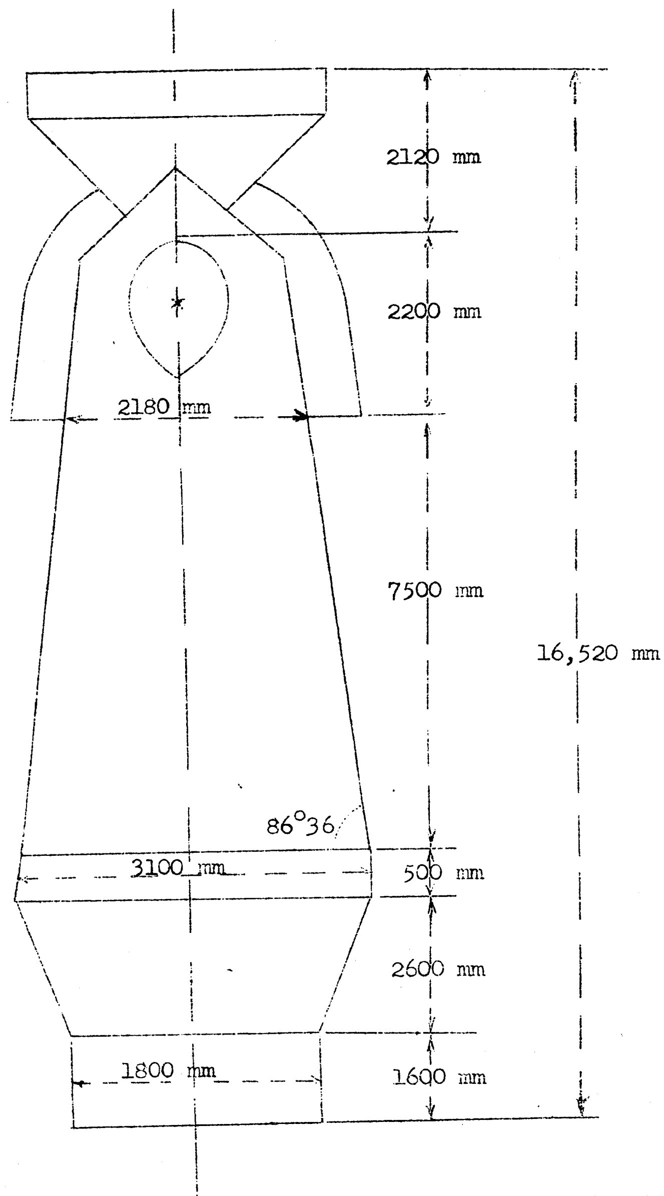
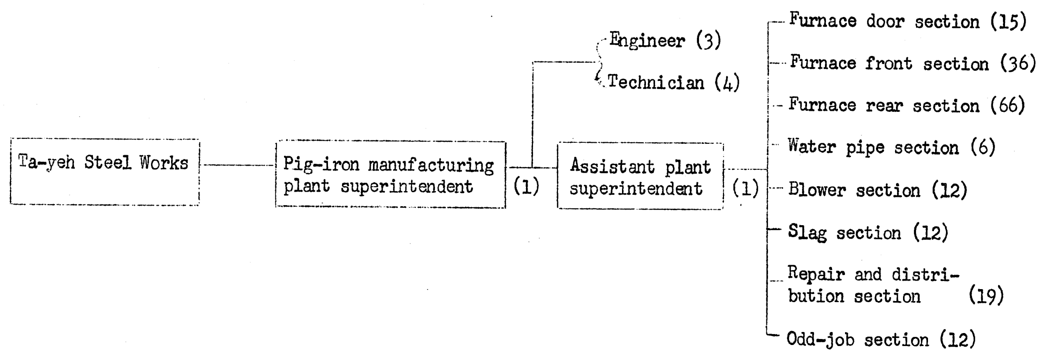


Chart No 13-6

Operational Setup and Personnel Distribution
of the Pig-iron Manufacturing Plant
(May 1953)

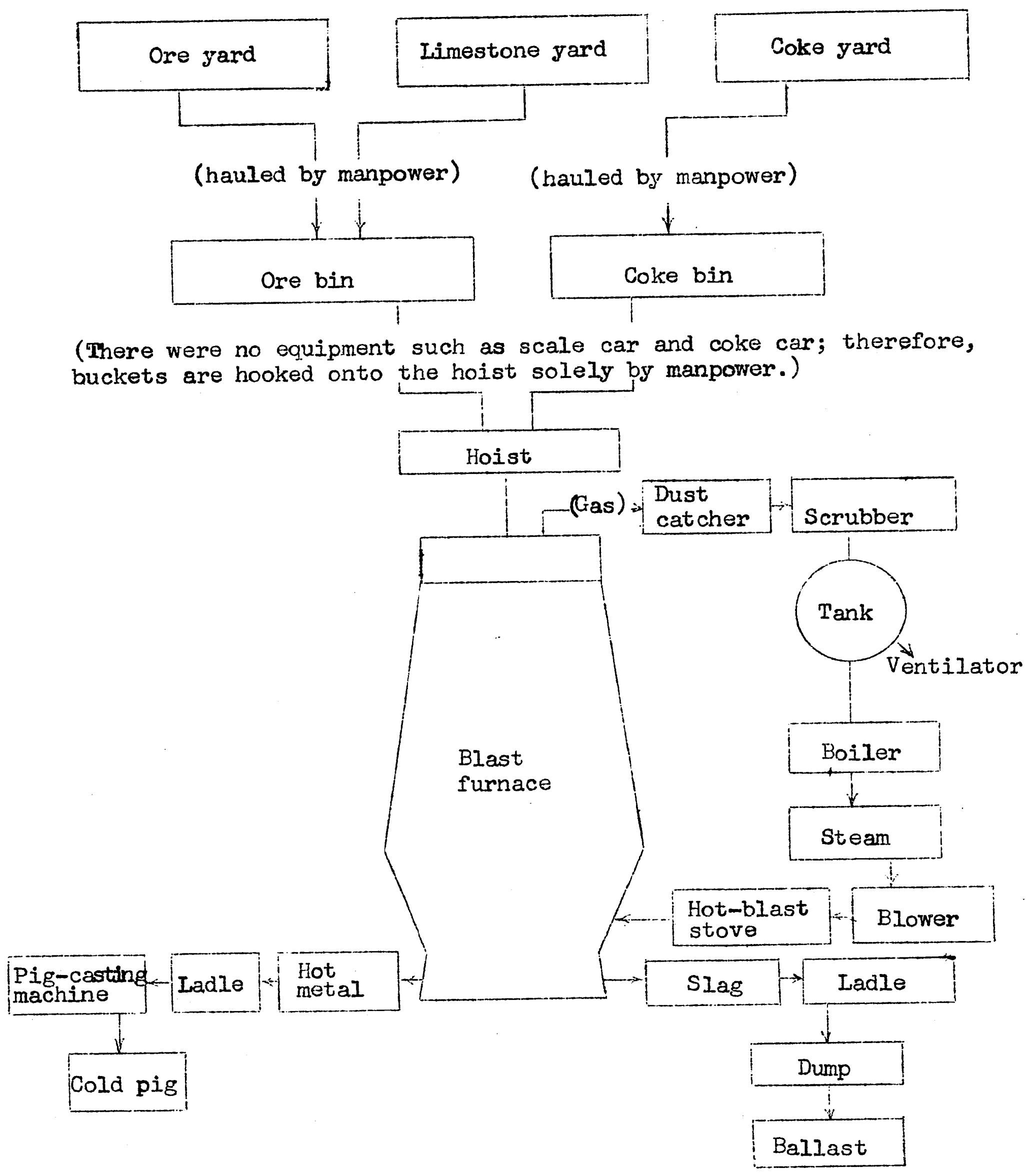


Note: Figures in parentheses denote number of personnel.

Doc No 90225 (13) (PB)

Chart No 13-7

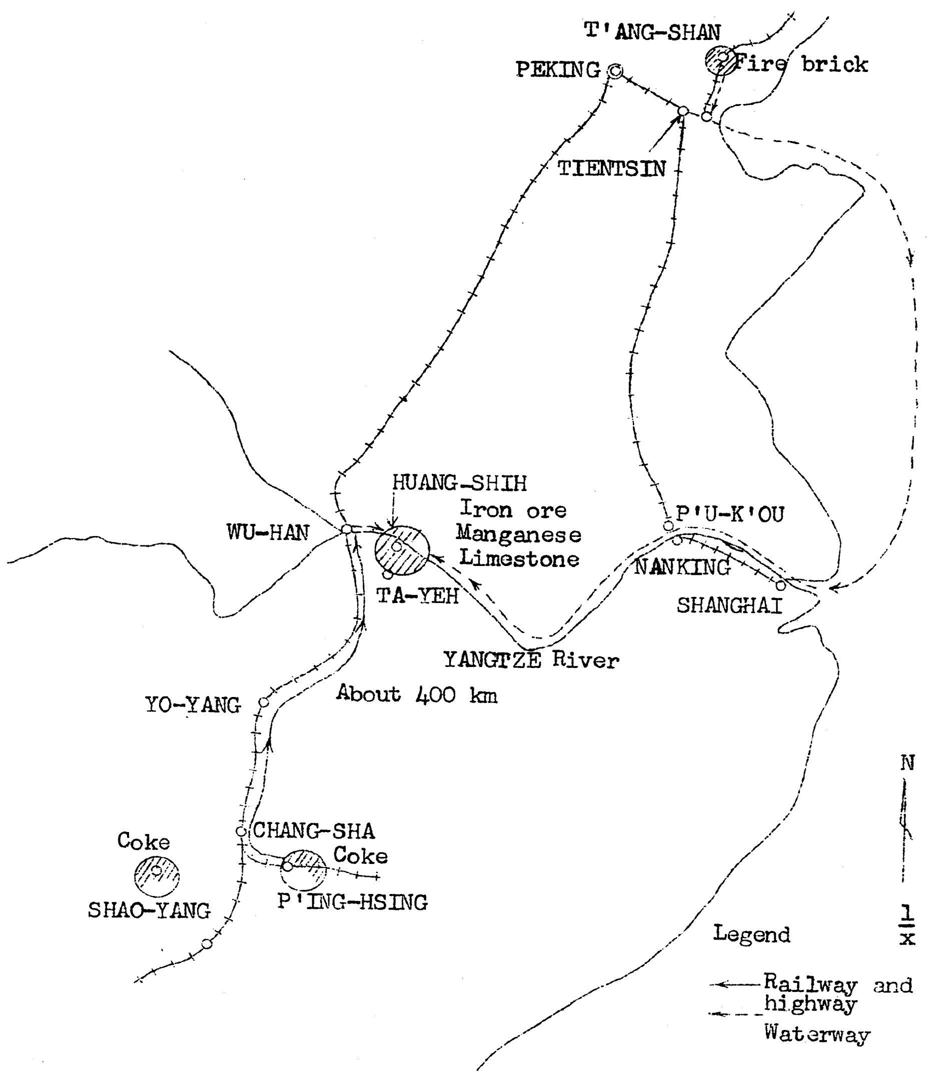
Flowchart of the Blast Furnace



Doc No 90225 (13) (PB)

Chart No 13-8

Transportation Route of Raw Materials for Pig-iron Production at Ta-yeh Steel Works (May 1953)



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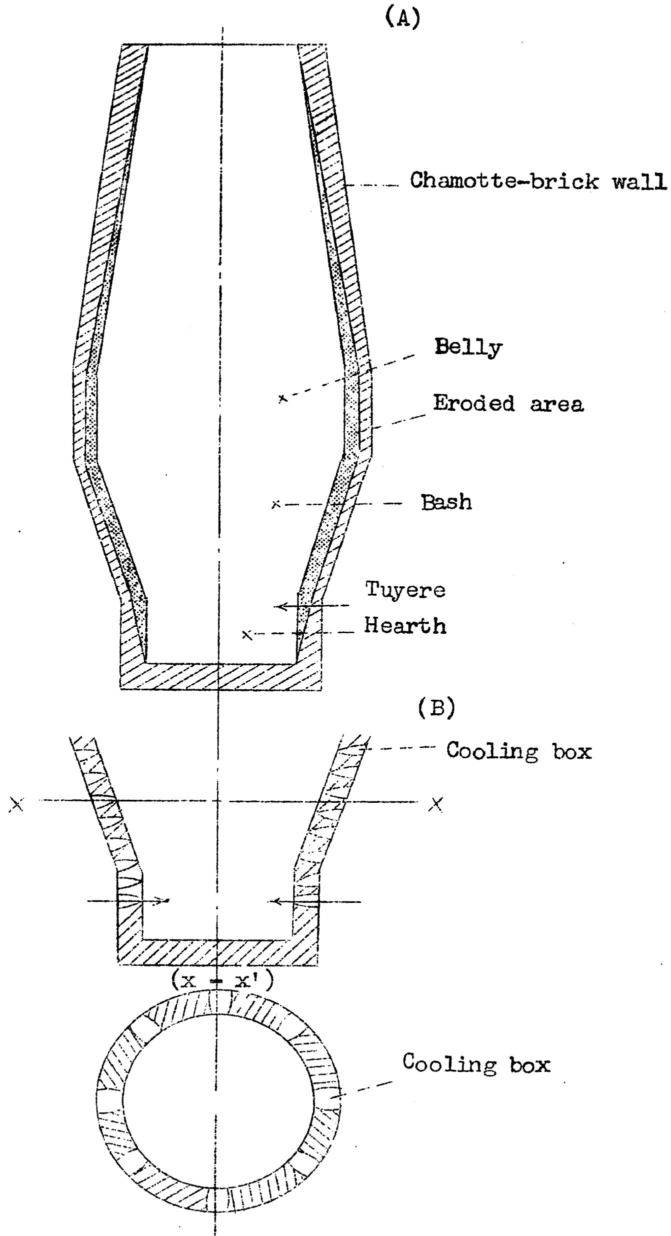
Doc No 90225 (13) (PB)

Chart No 13-9

Erosion and Cooling Box Layout of Small Blast Furnace



Doc No 90225 (13) (PB)

Chart No 13-10

Layout of Facilities at Steel-making Plant (May 1953)

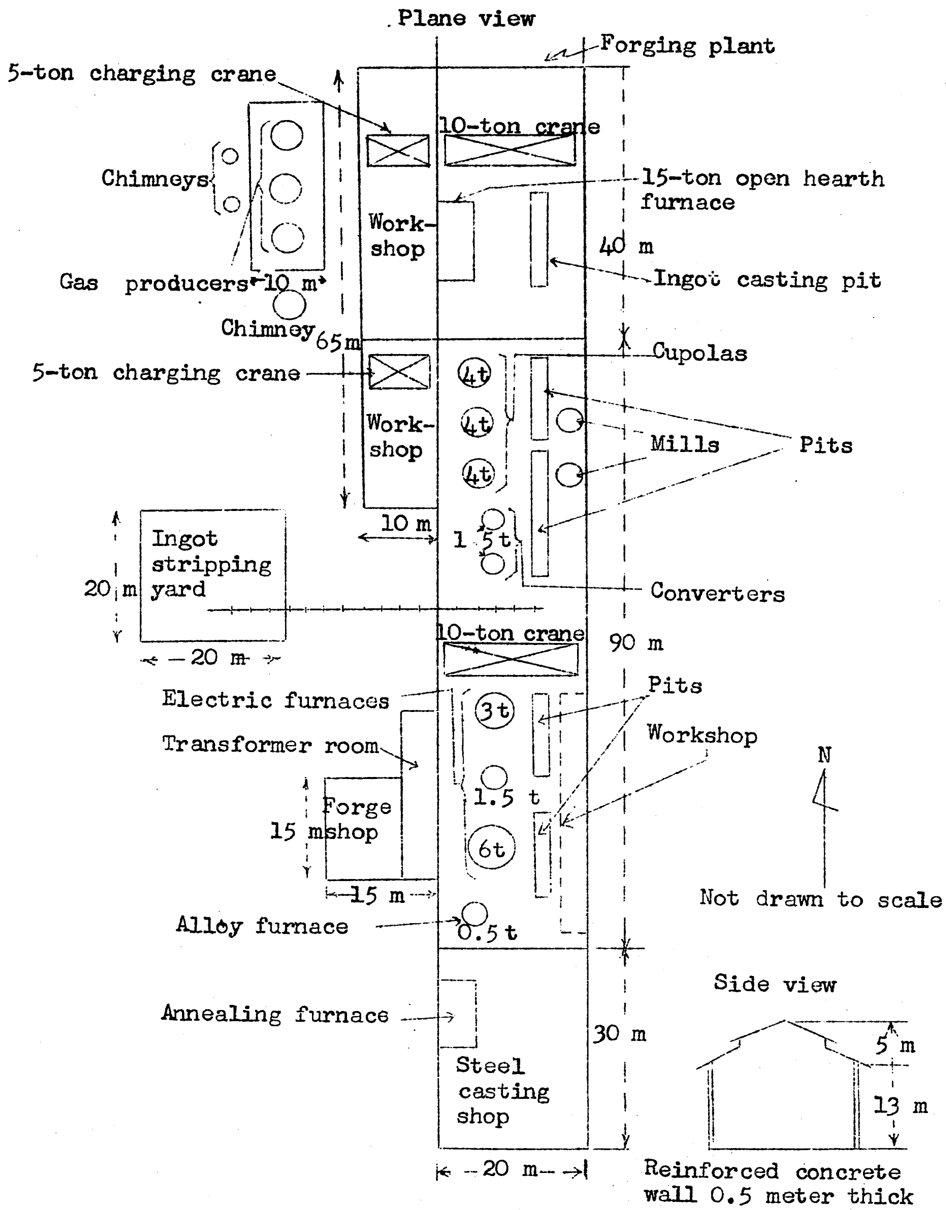


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Chart No 13-11

Structure of Bessemer Converter

Note: See Table No 13-11 for letters used in this illustration.

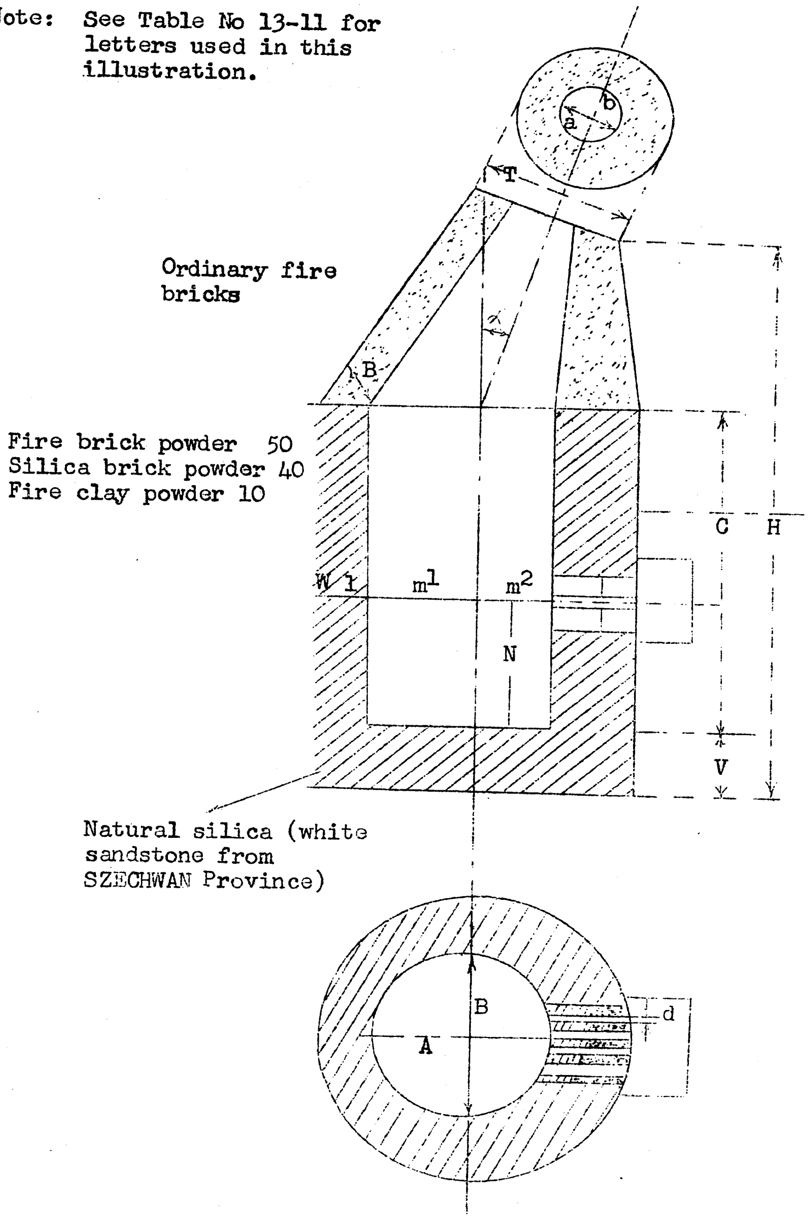

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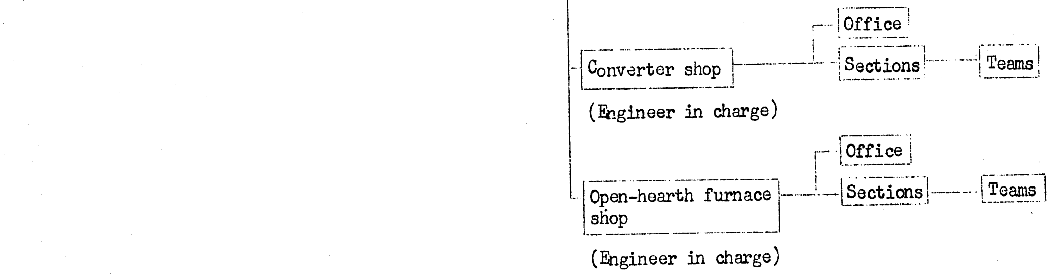
Chart No 13-12

Operational Setup of Steel Manufacturing Plant
(May 1953)



Note: In May 1953, an analysis and inspection office was under formation within the Steel Manufacturing Plant.

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Chart No 13-13

Open-hearth Process Flowchart

(Hours)	1 hour	2 hours		20 minutes	40 minutes		10 minutes	10 minutes	
(Order)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(Work)	Charging of raw materials	Heating → Melting	Melting down	Oxidation	Reduction	Tapping	Ladle	Teeming	Stripping
				Add iron ore; Slagging off; Add iron ore; Add manganese ore	Add CaO; Add CaF_2; Add CaO; Add Fe-Mn		Add FeSi; Add Al	(Bottom pouring method)	(Ingot 180 kg x 80)

Charging order

(Cold charging)

Top

Fifth layer	Pig iron
Fourth layer	CaO
Third layer	Heavy scrap steel ($\frac{1}{2}$)
Second layer	Manganese ore Iron ore
First layer	Scrap steel ($\frac{1}{2}$)

Bottom

(Hot charging)

Seventh layer	Hot metal (900 kg)
Sixth layer	Heavy scrap steel (150 kg)
Fifth layer	Large scrap steel (150 kg)
Fourth layer	Iron ore (200 kg)
Third layer	Manganese ore (200 kg)
Second layer	CaO (600 kg)
First layer	Scrap steel (300 kg)

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Chart No 13-14

Example of Converter Process of Steel Manufacture

(Hours): Cupola ← 20 - 25 minutes → ← 10 minutes → Converter ← 14 - 15 minutes → ← 5 - 6 minutes →

(Order)	(1)	(2)	(3)	(4)	(5)		(6)	(7)	(8)
(Work)	Charging of raw materials →	Tapping →	Desulphurization within ladle →	Pouring into converter →	Processing within converter →		Tapping into ladle →	Teeming into mold →	Stripping
	Mixing ratio	Chemical composition of hot metal	Desulphurization by use of Na_2CO_3 (add Na_2CO_3 + CaO)	Hot metal temperature, 1,300° to 1,350°C; Amount of hot metal, 2,000 kg	(Processing starts)	(Processing completed)	Add 7 kg of Fe-Mn (60% Mn)	(bottom pouring method - - 1,550° to 1,580°C)	Ingot (120 kg) x 2
	Low-phosphorus pig iron 1,075 kg	C 3.0 - 4.0%			(Oxidation of Si and Mn completed; oxidation of C starts)	(Oxidation of C)	Add 17 kg of Fe-Si (65% Si)	(Amount of steel bath: 1,650 kg)	
	Scrap steel 70 kg	Mn 0.4 - 0.6%					Add 0.6 kg of Al		
	Coke 150 kg	Si 0.8 - 1.2%							

Chart No 13-15

Electric Furnace Operational Process

(Hours)	10 minutes	One hour	1 - 1.5 hours	20 minutes		40 minutes	20 minutes	1.5 hours		5 - 10 minutes	
(Order)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(Work)	Minor repair →	Charging of raw materials →	Melting →	Melting down (1,560°C) →	Raising temperature →	Oxidation →	Slagging off →	Slag making →	Reducing →	Tapping →	Pouring into ladle →
	Minor repair on damaged section of hearth (stamping of MgO)	Charge scrap steel or steel bath from converter	Sending of high voltage electricity starts. Add CaO - 10 kg per ton of steel	Add CaO 10 kg per ton of steel	High voltage 1,650° to 1,670°C						

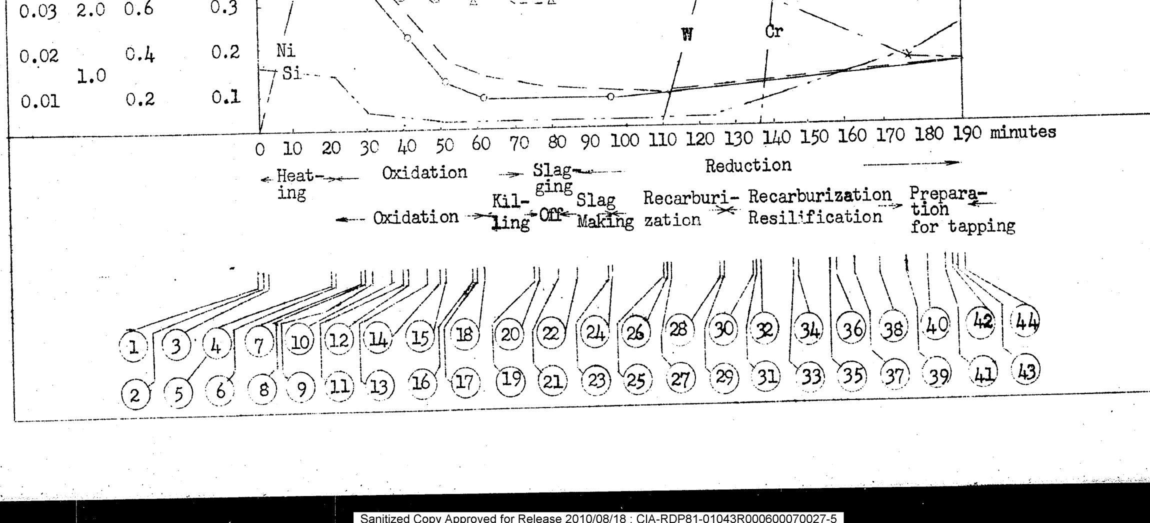
(Hours)	5 minutes	
(Order)	(12)	(13)
(Work)	→ Casting in cases →	Stripping

Remarks: The processes which follows the melting down process differ according to the type of special steel. Refer to Charts No 13-16 through Charts No 13-25.

Chart No 13-16

Operational Standard for Special Steel Manufacturing Process

Type of Steel		C	Mn	Si	Cr	W	Ni	P	S	
	18XHBA	0.15-0.22	0.4-0.55	0.17-0.37	1.3-1.5	0.8-1.2	4.0 4.5	< 0.03	< 0.03	(3-ton Electric Furnace Process, Example 1)



Doc No 90225 (13) (PB)

Chart No 13-16 (Cont'd)

KEY

1 Melt down, stir, analyze sample (C, Mn)
2 Add Ni (4.25%) here if not added before melt down
3 Add 10 kg CaO, 2 kg CaF_2
4 Stir, test temperature and slag
5 Analyze sample (C, Mn, Ni, P)
6 Add 10 kg Fe_2O_3, 5 kg CaO, 1 kg CaF_2
7 Stir, analyze sample (C, Mn, Ni, P)
8 Add FeMn (Mn 0.1%)
9 Add 10 kg Fe_2O_3
10 Remove 50% of slag, add 10 kg CaO, 3 kg CaF_2
11 Stir, analyze sample (C, Mn), add FeMn (Mn 0.1%)
12 Add 10 kg Fe_2O_3, 5 kg CaO, 2 kg CaF_2
13 Remove 80% of slag, add 10 kg CaO, 3 kg CaF_2, adjust Ni
14 Stir, analyze sample, (C, Mn, P)
15 Add 5 kg Fe_2O_3, 5 kg CaO, 2 kg CaF_2
16 Stir, analyze sample (C, Mn, Ni, P)
17 Add FeMn (Mn 0.5%)
18 Remove 50% of slag (no slagging materials added)
19 Forging bending test
20 Stir, analyze sample (C, Mn, P)
21 Remove all slag
Add 15 kg CaO, 3 kg CaF_2, FeMn (Mn 0.15%)
22 Add 10 kg CaO, 3 kg CaF_2
23 Stir, analyze sample (C, Mn)
24 Add 5 kg CaO, 1 kg CaF_2, 1.5 kg C powder
25 Stir, analyze sample (C)
26 Add FeW (W 1%)
27 Add 5 kg CaO, 1 kg CaF_2, 1 kg C powder
28 Stir, analyze sample (C, W)
29 Add 3 kg CaO, 1 kg CaF_2, 0.5 kg C powder, 2 kg FeSi powder (white slag materials)
30 Stir, analyze sample (C, W)
31 Add FeCr (Cr 1.4%)
32 Add white slag materials
33 Stir, analyze sample, (C, Mn, Ni, W, Cr)
34 Add 3 kg CaO, 1 kg CaF_2, 2 kg FeSi powder, 0.5 kg Al powder
35 Stir, analyze sample (C, Cr)

Doc No 90225 (13) (PB)

Chart No 13-16 (Cont'd)

KEY

36 Add 3 kg CaO, 1 kg CaF_2, 1 kg FeSi powder, 0.5 kg Al

37 Correct W

38 Correct Cr, add 3 kg CaO, 1 kg CaF_2, 1 kg FeSi powder, 0.5 kg Al

39 Add 5 kg AMS (Al 5% Mn 10% Si 5% deoxidizer)

40 Stir

41 FeSi (Deficiency added after analysis of sample)

42 Analyze slag, sample

43 Add 0.7 kg Al

44 Tap steel

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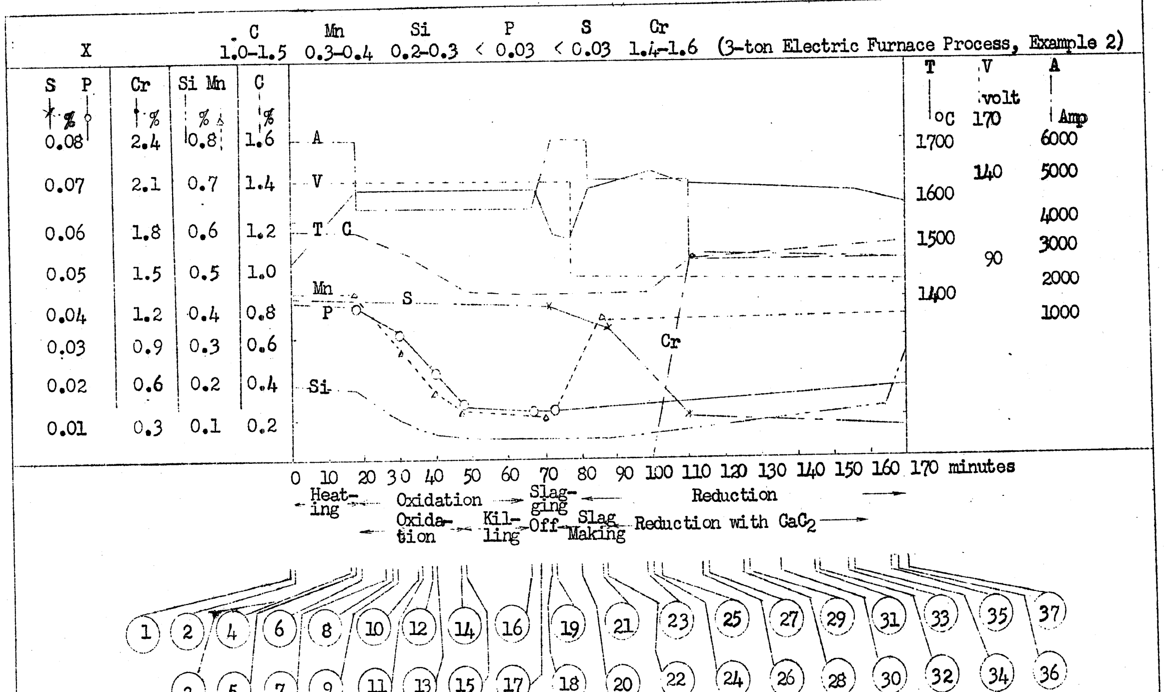
Chart No 13-17

Operational Standard for Special Steel Manufacturing Process



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Doc No 90225 (13) (PB)

Chart No 13-17 (Cont'd)

KEY

1 Melt down, stir, analyze sample (C, Mn)

2 Add 10 kg CaO, 2 kg CaF_2

3 Stir, test temperature and slag

4 Analyze sample (C, Mn, P)

5 Add 10 kg Fe_2O_3

6 Add 5 kg CaO, 1 kg CaF_2

7 Stir, analyze sample (C, P)

8 Add 10 kg Fe_2O_3

9 Add 5 kg CaO, 1 kg CaF_2

10 Remove 70% of slag

11 Add 10 kg CaO, 3 kg CaF_2

12 Stir, analyze sample (C, P)

13 Add 10 kg Fe_2O_3, 5 kg CaO, 1 kg CaF_2

14 Stir, analyze sample (C)

15 Remove 50% of slag (no slagging materials added)

16 Stir, analyze sample (C, Mn, P)

17 Remove all slag

18 Add 15 kg CaO, 4 kg CaF_2

19 Add FeMn (Mn 0.25%)

20 Add 10 kg CaO, 3 kg CaF_2, 2 kg C powder

21 Stir, analyze sample (C, Mn)

22 Add 5 kg CaO, 1.5 kg CaF_2, 2.5 kg C powder

23 Stir, analyze sample (C, Mn)

24 Add FeCr (Cr 1.5%)

25 3 kg CaO, 1 kg CaF_2, 1 kg C powder

26 Stir, analyze sample (C, Cr)

27 3 kg CaO, 1 kg CaF_2, 1 kg C powder

Doc No 90225 (13) (PB)

Chart No 13-17 (Cont'd)

KEY (Cont'd)

28 Stir, analyze sample (C, Cr)

29 Add 3 kg CaO, 1 kg CaF_2, 1 kg C powder, 1 kg FeSi powder

30 Add 3 kg CaO, 1 kg CaF_2, 0.5 kg C powder, 1 kg FeSi powder

31 Stir, analyze sample (C)

32 Add 3 kg CaO, 1 kg CaF_2, 0.5 kg C powder, 1 kg FeSi powder

33 Stir, analyze sample (C, Mn, Cr, P, S)

34 Breakdown CaO_2

35 Add FeSi (Si 0.1)

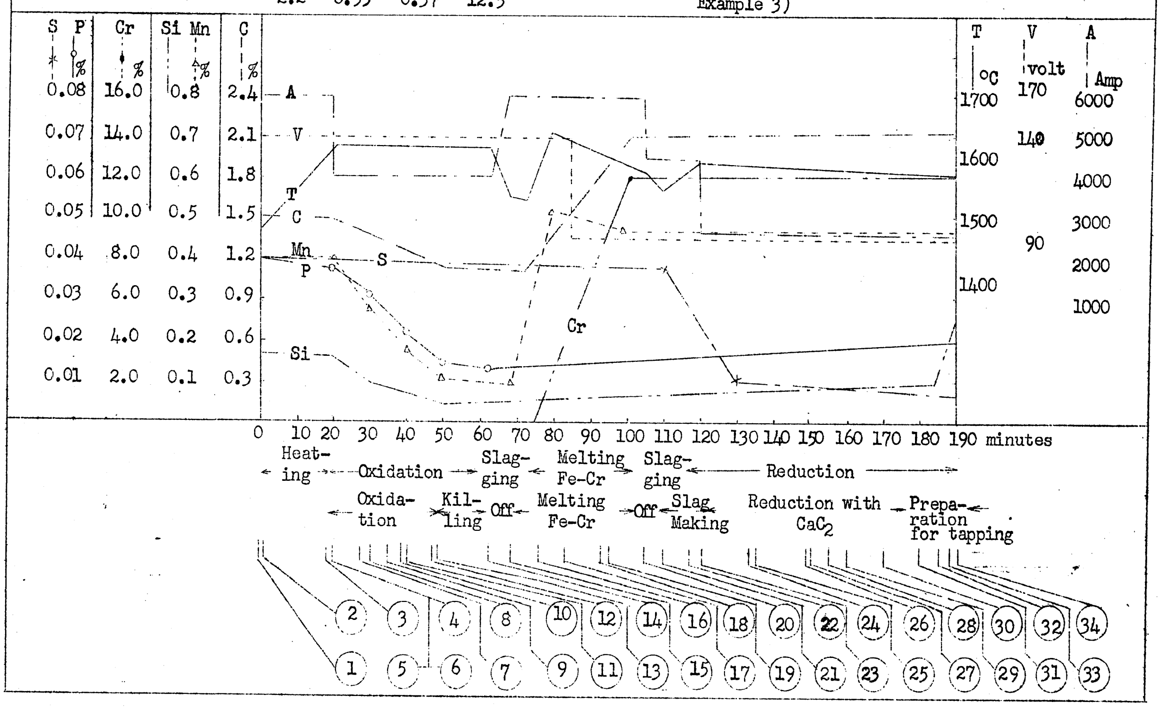
36 Add Al 0.06%

37 Tap steel

Chart No 13-18

Operational Standard for Special Steel Manufacturing Process

Type of Steel		C	Mn	Si	Cr	P	S	
Type of Steel	X 12	2.0-2.2	0.40-0.55	0.17-0.37	11.5-12.5	<0.03	<0.03	(3-ton Electric Furnace Process, Example 3)



Doc No 90225 (13) (PB)

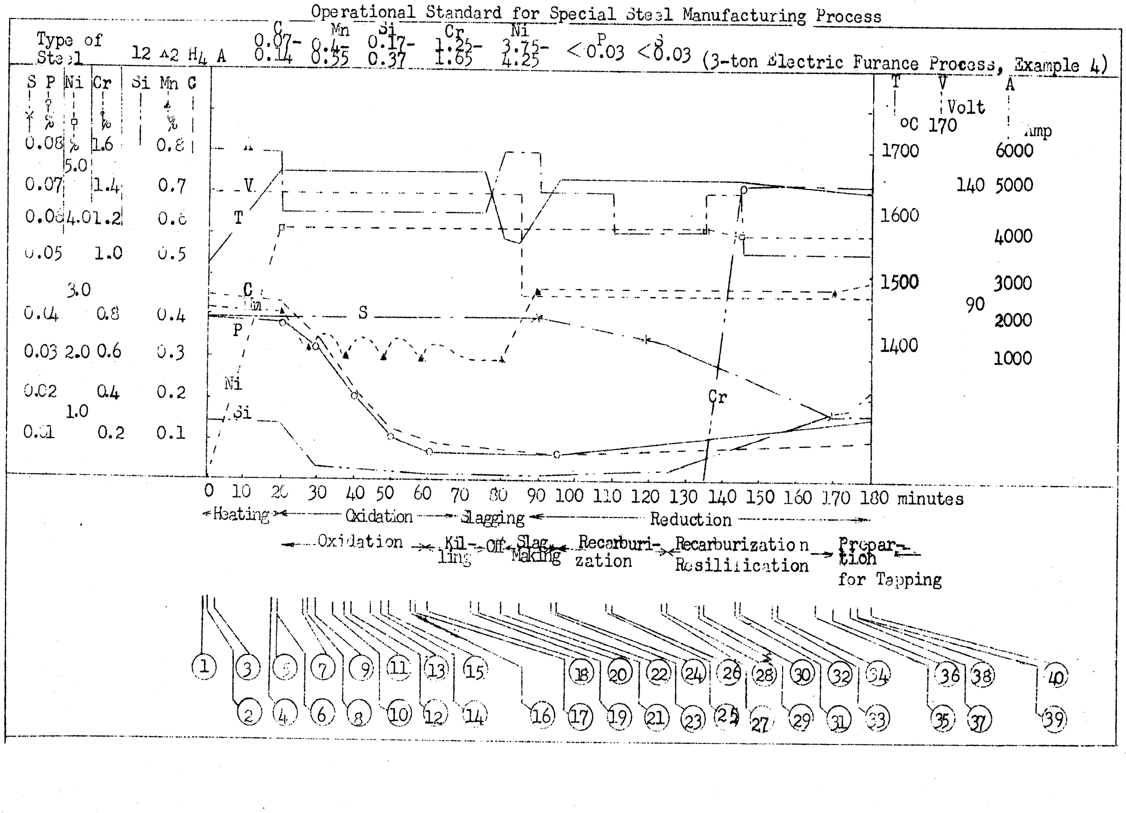
Chart No 13-18 (Cont'd)

KEY

1 Melt down, stir, analyze sample (C, Mn)
2 Add 10 kg CaO, 2 kg CaF_2
3 Stir, test temperature and slag
4 Analyze sample (C, Mn, P)
5 Add 10 kg Fe_2O_3
6 Add 5 kg CaO, 1 kg CaF_2
7 Stir, analyze sample (C, P)
8 Add 10 kg Fe_2O_3, 5 kg CaO, 1 kg CaF_2
9 Remove 50% of slag, add 10 kg CaO, 3 kg CaF_2
10 Stir, analyze sample (C, P)
11 Add 10 kg Fe_2O_3, 5 kg CaO, 1 kg CaF_2
12 Stir, analyze sample (C)
13 Remove 50% of slag (no slagging materials added)
14 Stir, analyze sample (C, Mn, P)
15 Remove all slag
Add 20 kg firebrick dust, FeMn (Mn 0.35%)
16 Add FeCr (Cr 5%)
17 Add FeCr (Cr 4%)
18 Add FeCr (Cr 3%)
19 Add 5 kg firebrick dust, 2 kg CaF_2, 2 kg FeSi powder
20 Stir
Remove all slag
21 Add 15 kg CaO, 4 kg CaF_2, 1 kg C powder
22 Stir, analyze sample (C, Mn, Cr)
23 Add 10 kg CaO, 3 kg CaF_2, 3 kg C powder (carbide slag materials)
24 Stir, analyze sample (C, Mn, Cr)
25 Add 5 kg CaO, 1.5 kg CaF_2, 2 kg C powder
26 Stir, analyze sample (C)
27 3 kg CaO, 1 kg CaF_2, 1 kg C powder (carbide slag materials)
28 Correct Mn, Cr
29 3 kg CaO, 1 kg CaF_2, 1 kg C powder (carbide slag materials)
30 Stir, analyze sample (C, Mn, Cr, P, S)
31 Breakdown CaC_2
32 Add FeSi (Si 0.12%)
33 Add 0.5 kg Al
34 Tap steel

Chart No 13-19

Operational Standard for Special Steel Manufacturing Process



Doc No 90225 (13) (PB)

Chart No 13-19 (Cont'd)

KEY

1 Melt down, stir, analyze sample (C, Mn)

2 Add Ni 4% here if not added before melt down

3 Add 10 kg CaO, 2 kg CaF_2

4 Stir, test temperature and slag

5 Analyze sample (C, Mn, Ni, P)

6 Add 10 kg Fe_2O_3, 5 kg CaO, 1 kg CaF_2

7 Stir, analyze sample (C, Mn, Ni, P)

8 Add Fe Mn (Mn 0.1%)

9 Add 1 kg Fe_2O_3

10 Remove 50% of slag, add 10 kg CaO, 3 kg CaF_2

11 Stir, analyze sample (C, Mn), add FeMn (Mn 0.1%)

12 Add 10 kg Fe_2O_3

13 Remove 50% of slag, add 10 kg CaO, 3 kg CaF_2, adjust Ni

14 Stir, analyze sample (C, Mn, P), add FeMn (Mn 0.1%)

15 5 kg Fe_2O_3, 5 kg CaO, 2 kg CaF_2

16 Stir, analyze sample (C, Mn, Ni, P)

17 Add FeMn (Mn 0.1%)

18 Remove 50% of slag (no slaggings materials added)

19 Forging bending test

20 Stir, analyze sample (C, Mn, P)

21 Remove all slag
Add 15 kg CaO, 3 kg CaF_2, FeMn (Mn 0.15%)

22 Add 10 kg CaO, 3 kg CaF_2

23 Stir, analyze sample (C, Mn)

24 Add 5 kg CaO, 1 kg CaF2, 1 kg C powder

25 Stir, analyze sample (C)

26 Add 5 kg CaO, 1 kg CaF_2, 1.5 kg C powder

27 Stir, analyze sample (C)

28 Add 3 kg CaO, 1 kg CaF_2, 0.5 kg C powder, 2 kg FeSi powder (white slag materials)

Doc No 90225 (13) (PB)

Chart No 13-19 (Cont'd)

KEY

29 Add FeCr (Cr 14%)

30 Add white slag materials

31 Stir, analyze sample (C, Mn, Ni, Cr)

32 Add 3 kg CaO, 1 kg CaF_2, 2 kg FeSi powder, 0.5 kg Al powder

33 Stir, analyze sample (C, Cr, P, S)

34 Add 3 kg CaO, 1 kg CaF_2, 1 kg FeSi powder, 0.5 kg Al powder

35 Adjust Cr

36 Add 5 kg AMS (Al 5% Mn 10% Si 5% deoxidizer)

37 FeSi (add appropriate amount if sample shows less than 0.5%)

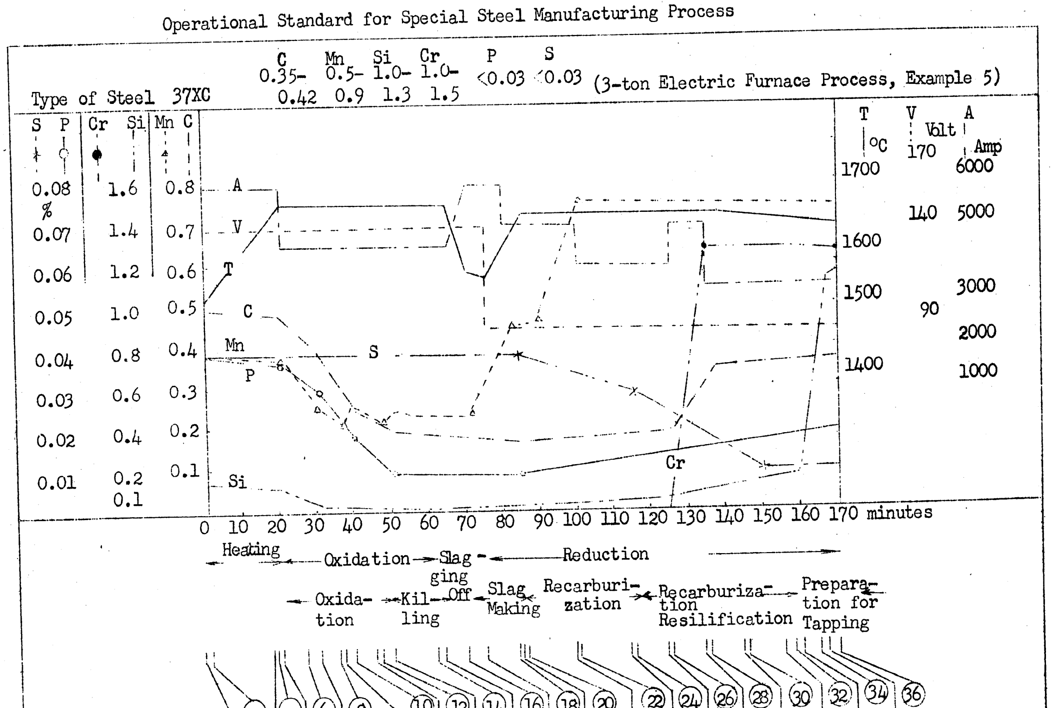
38 Analyze slag, sample

39 0.7 kg Al

40 Tap steel

Chart No 13-20

Operational Standard for Special Steel Manufacturing Process



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Doc No 90225 (13) (PB)

Chart No 13-20 (Cont'd)

KEY

1 Melt down, stir, analyze sample (C, Mn)

2 Add 10 kg CaO, 2 kg CaF_2

3 Stir, test temperature and slag

4 Analyze sample (C, Mn, P)

5 Add 10 kg Fe_2O_3

6 Add 5 kg CaO, 1 kg CaF_2
Stir, analyze sample (C, Mn, P)

7 Add 10 kg Fe_2O_3, 5 kg CaO, 1 kg CaF_2

8 Stir, analyze sample (C, Mn)

9 Remove 70% of slag, add 10 kg CaO, 2 kg CaF_2, FeMn (Mn 0.1%)

10 Add 5 kg Fe_2O_3

11 Add 5 kg Fe_2O_3, 5 kg CaO, 1 kg CaF_2

12 Stir, analyze sample (C, Mn, P), add FeMn (Mn 0.1%)

13 Remove 50% of slag (no slagging materials added)

14 Forging bending test

15 Stir, analyze sample (C, Mn, P)

16 Remove all slag
Add FeMn (Mn 0.2%), 15 kg CaO, 4 kg CaF_2

17 Add 10 kg CaO, 3 kg CaF_2, 1 kg C powder

18 Stir, analyze sample (C, Mn)

19 Add FeMn (Mn 0.3%)

20 Add 5 kg CaO, 1.5 kg CaF_2, 1.5 kg C powder

21 Stir, analyze sample (C, Mn)

22 Add 5 kg CaO, 1.5 kg CaF_2, 2 kg C powder

23 Stir, analyze sample (C, Mn)

24 Add 3 kg CaO, 1 kg CaF_2, 0.5 kg C powder, 2 kg FeSi powder (white slag materials)

25 Add Fe Cr (Cr 1.25%)

26 Add white slag materials

27 Stir, analyze sample (C, Cr)

Doc No 90225 (13) (PB)

Chart No 13-20 (Cont'd)

KEY

28 Add white slag materials

29 Stir, analyze sample (C, Cr)

30 Add 3 kg CaO, 1 kg CaF_2, 1 kg FeSi powder

31 Correct Cr

32 Remove 50% of slag

33 Add FeSi (Si 1%)

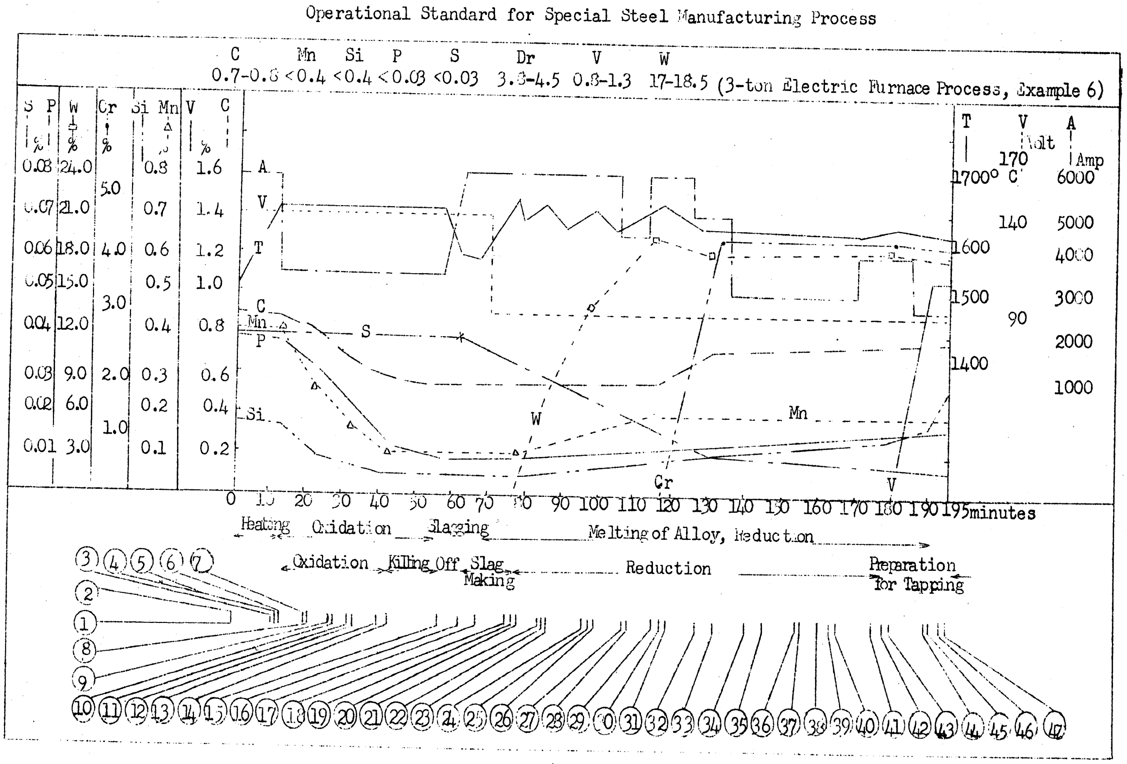
34 Analyze slag, sample

35 Add 0.5 kg Al

36 Tap steel

Chart No 13-21

Operational Standard for Special Steel Manufacturing Process



Doc No 90225 (13) (PB)

Chart No 13-21 (Cont'd)

KEY

1 Melt down, stir, analyze sample (C, Mn)

2 Add 10 kg CaO, 2 kg CaF_2

3 Stir, test temperature and slag

4 Analyze sample (C, Mn, P)

5 Add 7 kg Fe_2O_3

6 Add 5 kg CaO, 1 kg CaF_2

7 Stir, analyze sample (C, P)

8 Add 7 kg Fe_2O_3, 5 kg CaO, 1 kg CaF_2

9 Remove 50% of slag

10 Add 10 kg CaO, 3 kg CaF_2

11 Stir, analyze sample (C, P)

12 Add 7 kg Fe_2O_3, 5 kg CaO, 1 kg CaF_2

13 Stir, analyze sample (C)

14 Remove 50% of slag (no slagging materials added)

15 Stir, analyze sample (C, Mn, P)

16 Remove all slag
Add 12 kg CaO, 3 kg CaF_2

17 10 kg CaO, 3 kg CaF_2, 2 kg C powder

18 Stir, analyze sample (C)

19 Add 1/3 of FeW

20 Add 3 kg CaO, 1 kg CaF_2, 0.5 kg C powder

21 Stir

22 Add 1/3 of FeW

23 3 kg CaO, 1 kg CaF_2, 0.5 kg C powder

24 Stir

25 Add 1/3 of FeW

26 3 kg CaO, 1 kg CaF_2, 0.5 kg C powder

27 Stir

28 Add 3 kg CaO, 1 kg CaF_2, 0.5 kg C powder, 2 kg FeSi powder

Doc No 90225 (13) (PB)

Chart No 13-21 (Cont'd)

KEY

29 Stir, analyze sample (C, W, Mn, P)

30 Add FeCr (Cr 4.2%)

31 Add 3 kg CaO, 1 kg CaF_2, 0.5 kg C powder, 1 kg FeSi powder

32 Add 3 kg CaO, 1 kg CaF_2, 0.5 kg C powder, 1 kg FeSi powder

33 Stir, analyze sample (C, Mn, Cr, P)

34 Add 3 kg CaO, 1 kg CaF_2, 0.5 kg C powder, 1 kg FeSi powder

35 Stir, analyze sample (W, Cr, C)

36 Stir, analyze sample (C)

37 Add 3 kg CaO, 1 kg CaF_2, 0.5 kg C powder, 1 kg FeSi powder

38 Correct FeW

39 Stir, analyze sample (C)

40 Add 3 kg CaO, 1 kg CaF_2, 0.5 kg C powder, 1 kg FeSi powder

41 Correct FeCr

42 Breakdown CaC_2

43 Add FeV

44 Analyze slag

45 Add FeSi

46 Add Al 0.06%

47 Tap steel

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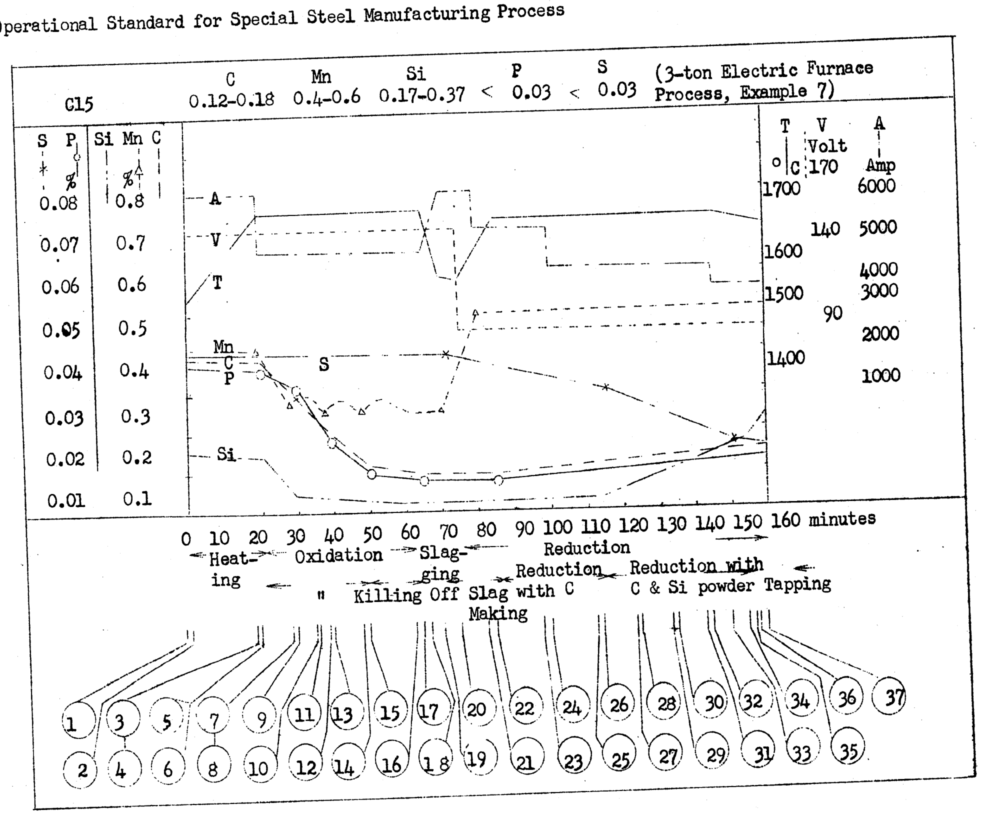
Chart No 13-22 Operational Standard for Special Steel Manufacturing Process



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Doc No 90225 (13) (PB)

Chart No 13-22 (Cont'd)

KEY

1 Melt down, stir, analyze sample (C, Mn)

2 Add 10 kg CaO, 2 kg CaF_2

3 Stir, test temperature and slag

4 Analyze sample (C, Mn, P)

5 Add 10 kg Fe_2O_3

6 Add 5 kg CaO, 1 kg CaF_2

7 Stir, analyze sample (C, Mn, P)

8 Add FeMn (Mn 0.1%)

9 Add 10 kg FeP_3

10 Remove 50% of slag

11 Add 10 kg CaO, 3 kg CaF_2

12 Stir, analyze sample (C, Mn, P), add FeMn (Mn 0.1%)

13 Add 7 kg Fe_2O_3

14 Stir, analyze sample (C, Mn, P), add FeMn (Mn 0.1%)

15 Remove 50% of slag (no slagging materials added)

16 Forging bending test

17 Stir, analyze sample (C, Mn, P)

18 Remove all slag

19 Add 1.5 kg CaO, 3 kg CaF_2, FeMn (Mn 0.15%)

20 Add 10 kg CaO, 3 kg CaF_2, 1 kg C powder

21 Stir, analyze sample (C, Mn)

22 Add 5 kg CaO, 1 kg CaF_2, 2 kg C powder

23 Stir, analyze sample (C, Mn)

24 Add 5 kg CaO, 2 kg CaF_2, 1.5 kg C powder

25 Stir, analyze sample (C)

26 3 kg CaO, 1 kg CaF_2, 0.5 kg C powder, 2 kg FeSi powder (white slag materials)

27 Stir, analyze sample (C)

28 Add white slag materials

Doc No 90225 (13) (PB)

Chart No 13-22 (Cont'd)

KEY

29 Stir, analyze sample (C)

30 Add white slag materials

31 Stir, analyze sample (C)

32 Add 3 kg CaO, 1 kg CaF_2, 1 kg FeSi powder, 0.5 kg Al powder

33 AMS (Al 5 %, Mn 10%, Si 5% deoxidizer)

34 Add FeSi (after sample test, to bring Si up to at least 0.17%)

35 Analyze slag

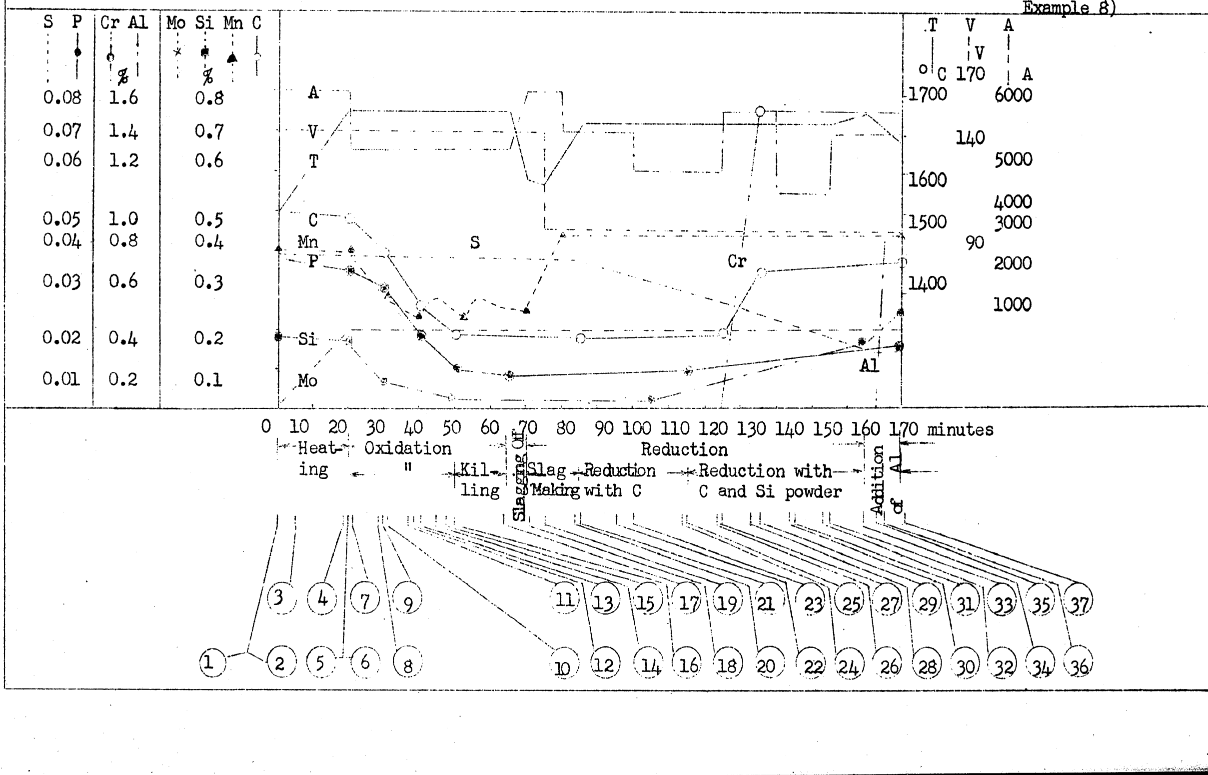
36 Add Al (Al 0.01%)

37 Tap steel

Chart No 13-23

Operational Standard for Special Steel Manufacturing Process

38XM Ю A	C	Mn	Si	Mo	Ni	Al	Cr	P	S	(3-ton Electric Furnace Process Example 8)
	0.35-0.42	0.3-0.6	0.17-0.37	0.15-0.25	< 0.4	0.7-1.1	1.35-1.65	< 0.035	< 0.035	



Doc No 90225 (13) (PB)

Chart No 13-23 (Cont'd)

KEY

1 Melt down, still, analyze sample (C, Mn, Ni)

2 Add FeMo (Mo 0.2%)

3 Add 10 kg CaO, 2kg CaF_2

4 Stir, test temperature and slag

5 Analyze sample (C, Mn, Mo, Ni, P)

6 Add 10 kg Fe_2O_3

7 Add 5 kg CaO, 1 kg CaF_2

8 Stir, analyze sample (C, Mn, Mo, P)

9 Add 10 kg Fe_2O_3

10 Add 5 kg CaO, 1 kg CaF_2

11 Stir, analyze sample (C, Mn)

12 Remove 70% of slag, add 10 kg CaO, 2 kg CaF_2, FeMn (0.1%)

13 Add 5 kg Fe_2O_3

14 Add 5 kg Fe_2O_3

15 Stir, analyze sample (C, Mn), add FeMn (Mn 0.1%)

16 Remove 50% of slag (no slagging materials added)

17 Stir, analyze sample (C, Mn, Mo, P)

18 Remove all slag
Add 15 kg CaO, 4 kg CaF_2, FeMn (Mn 0.2%)

19 Add 10 kg CaO, 3 kg CaF_2, 1 kg C powder

20 Stir, analyze sample (C, Mn, P)

21 Add 5 kg CaO, 2 kg CaF_2, 2 kg C powder

22 Stir, analyze sample (C, Mo)

23 Add 5 kg CaO, 2 kg CaF_2, 2 kg C powder

24 Stir, analyze sample (C)

25 3 kg CaO, 1 kg CaF_2, 2 kg FeSi powder, 0.5 kg C powder (add white slag materials)

26 Stir, add FeCr (Cr 1.5%)

27 Add white slag materials

28 Stir, analyze sample (C, Mn, Mo, Cr)

29 Add white slag materials

Doc No 90225 (13) (PB)

Chart No 13-23 (Cont'd)

KEY

30 Stir, analyze sample (C, Cr)

31 Add 3 kg CaO, 1 kg CaF_2, 1 kg FeSi powder

32 Stir

33 Add 3 kg CaO, 1 kg CaF_2, 1 kg FeSi powder

34 Remove slag (completely)

35 Add Al (1.1%)

36 Add 5 kg CaO, 5 kg CaF_2, 5 kg firebrick dust

37 Tap steel

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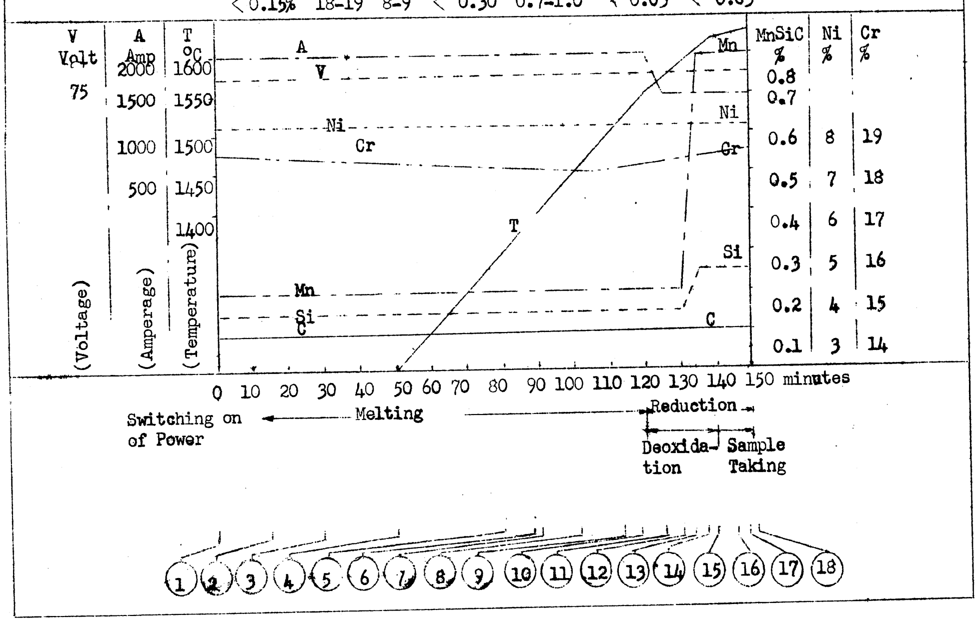
Chart No 13-24

Operational Standard for Special Steel Manufacturing Process

18-8 Cr-Ni Stainless Steel Non-Oxidizing Method (Example of 1-ton Electric Furnace Process)

C	Cr	Ni	Si	Mn	P	S
< 0.15%	18-19	8-9	< 0.30	0.7-1.0	< 0.03	< 0.03



Doc No 90225 (13) (PB)

Chart No 13-24 (Cont'd)

KEY

1 Charge 20 kg CaO, 620 kg 18-8 steel scrap, 250 kg 0.1% carbon steel, 46 kg FeNi (Ni 70%), 111 kg FeCr (Cr 68%)

2 Add 20 kg CaO, 7 kg CaF_2

3 Test and adjust slag

4 Test and adjust slag

5 80% melted, color of slag green

6 Take samples (C, Mn, Si, P, S, Cr, Ni analysis)

7 Add 5 kg FeTi (21%), 0.5 kg Al pieces

8 Add 12 kg CaO, 3 kg CaF_2

9 Take samples (C, Mn, Si, P, S, Cr, Ni analysis)

10 Melt down, add 5 kg FeTi, 0.5 kg Al pieces

11 Add 12 kg CaO, 3 kg CaF_2

12 Add 6 kg Mn, 2 kg FeSi

13 Add 5 kg FeTi, 1 kg Al pieces, 1 kg FeSi powder

14 White slag

15 Take samples, test sand mold and gas, make forging test

16 Take samples, test sand mold and gas, measure temperature

17 Add 0.5 kg Al

18 Add 0.2 kg Mg, tap steel

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Chart No 13-25

Operational Standard for Special Steel Manufacturing Process

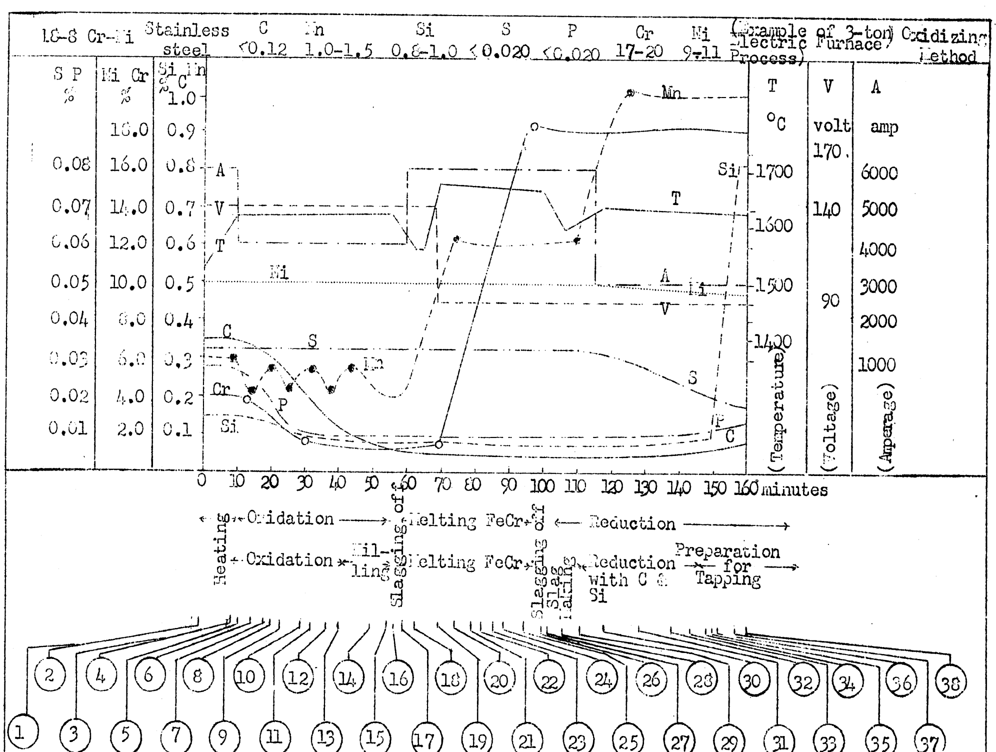

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Chart No 13-25 (Cont'd)

KEY

1 Melt down, stir

2 Analyze sample (C, Mn, P, Ni)

3 Stir, test temperature and slag

4 Analyze sample (C, Mn, P, Ni, Cr)

5 Add 4 kg Fe_2O_3, 4 kg CaO, 1 kg CaF_2

6 Add FeMn (Mn 0.1%)

7 Stir, analyze sample (C, Mn, P)

8 Add 3 kg Fe_2O_3, 3 kg CaO, 1 kg CaF_2

9 Add FeMn (Mn 0.1%)

10 Stir, analyze sample (C, Mn, P)

11 Add 3 kg Fe_2O_3, 3 kg CaO, 1 kg CaF_2

12 Add FeMn (Mn 0.1%), stir

13 Remove slag (50%)

14 Stir, analyze sample

15 Remove all slag

16 Add 10 kg chamotte dust

17 Add FeMn (Mn 0.45%)

18 Add 2 kg FeSi (Si 70%)

19 Add FeCr (Cr 7%)

20 Stir

21 Add FeCr (Cr 6%)

22 Stir

23 Add FeCr (Cr 5%)

24 Stir, add 5 kg chamotte dust

25 Stir, analyze sample (C, Mn, Cr)

26 Add 15 kg CaO, 4 kg CaF_2

27 Add 1 kg charcoal dust

28 Add 8 kg FeSi powder (Si 75%)

Chart 13-25 (Cont'd)

KEY (Cont'd)

29 Add FeMn ($C < 0.1\%$)(Mn, 0.4%)

30 Add 12 kg CaO, 3kg CaF_2, 0.5 kg C

31 Stir, analyze sample (C, Mn, Cr)

32 Adjust amount of Cr

33 Stir, analyze sample (C, Mn, Cr, P, S)

34 Add 10 kg FeTi (Ti 21%), 0.5 kg Al pieces

35 Add FeSi (Si 0.8%)

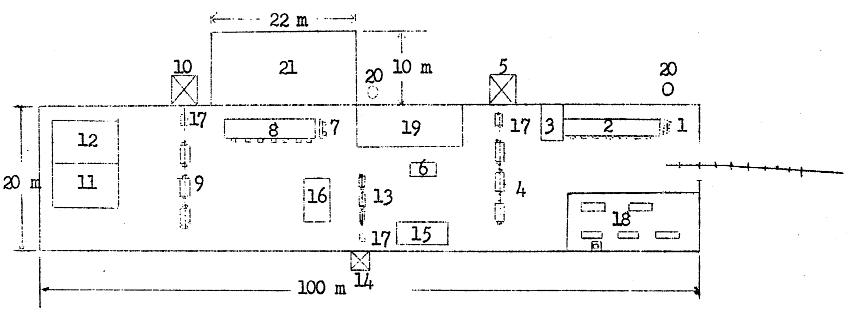
36 Take samples test sand molds and gas, measure temperature, make forging test

37 Add 0.5 kg Al

38 Tap steel

Chart No 13-26

Layout of Facilities in the Small Bar Mill
(May 1953)



Key

1 Ingot pusher
2 Continuous type heating furnace (I)
3 Combustion chamber
4 Three-high medium roll (for ordinary carbon steel)
5 Electric motor (600 hp)
6 Billet shearing machine
7 Billet pusher
8 Continuous type heating furnace (II)
9 Small three-high roll (for ordinary carbon steel)
10 Electric motor (600 hp)
11 Cooling bed
12 Products storage pit
13 Small three-high roll (for special steel)
14 Electric motor (350 hp)
15 Independent heating furnace (for special steel)
16 Sand pit for cooling purposes
17 Reduction gear
18 Lathe for making grooves in rollers
19 Workers' room
20 Chimney
21 Rolling mill office

0 4 8 12 16 20 m

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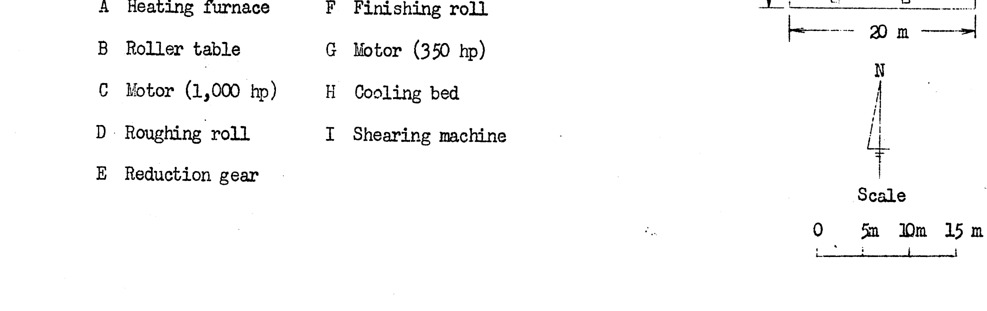
Chart No 13-27

Proposed Layout of Machinery in Large Bar Mill
(Under construction in May 1953)



Key

A Heating furnace

B Roller table

C Motor (1,000 hp)

D Roughing roll

E Reduction gear

F Finishing roll

G Motor (350 hp)

H Cooling bed

I Shearing machine

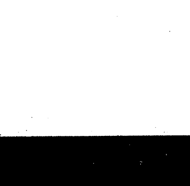


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Chart No 13-28

The Operational Setup of Rolling Mill

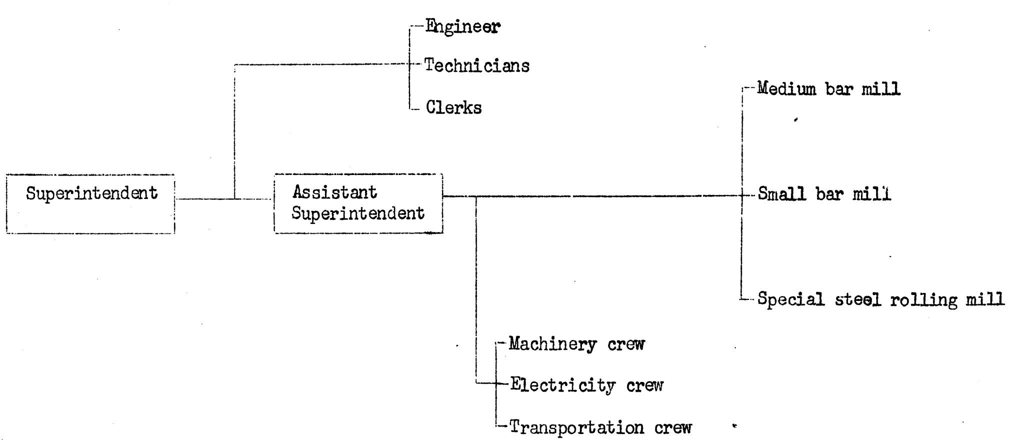

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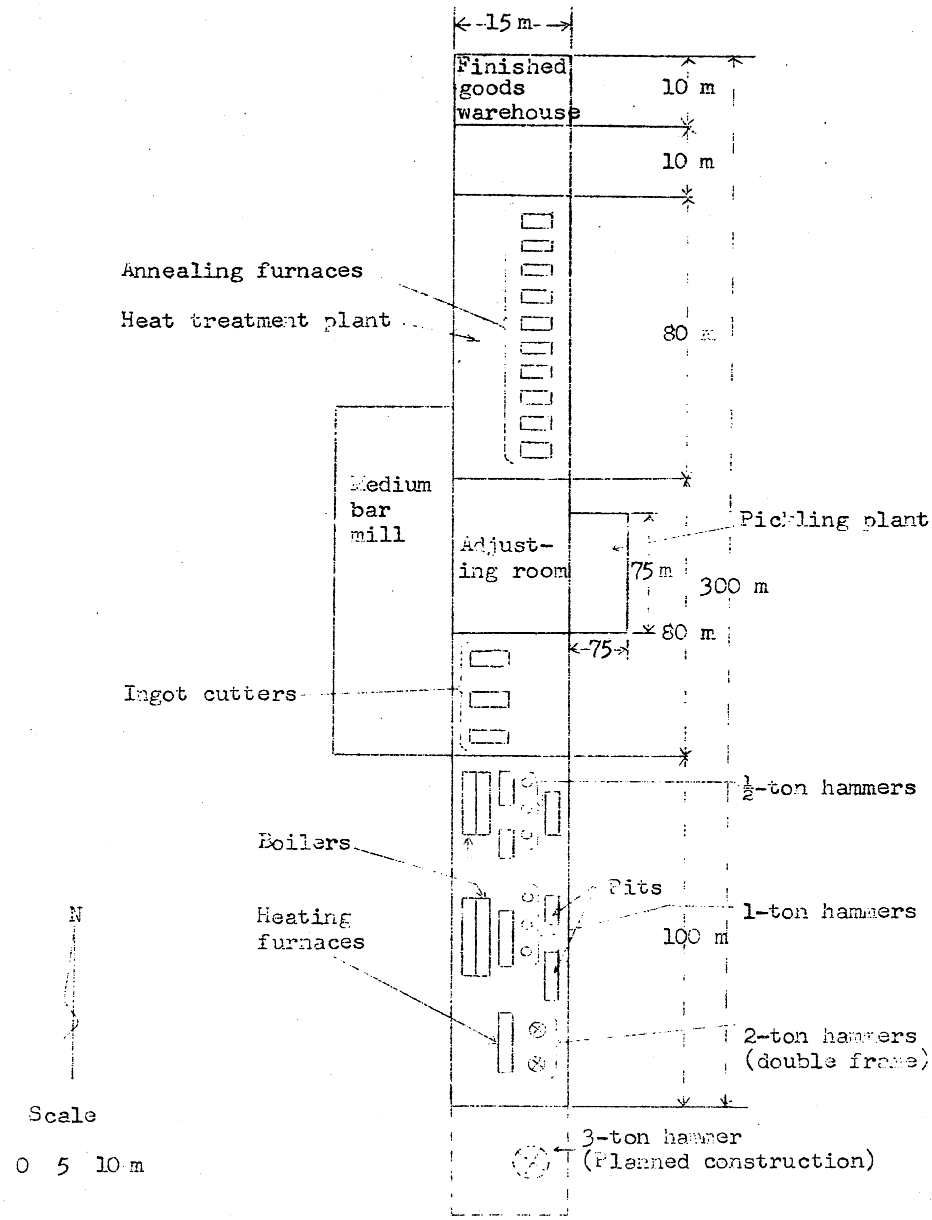
Chart No 13-29

Layout of Facilities of Forging Plant
(May 1953)



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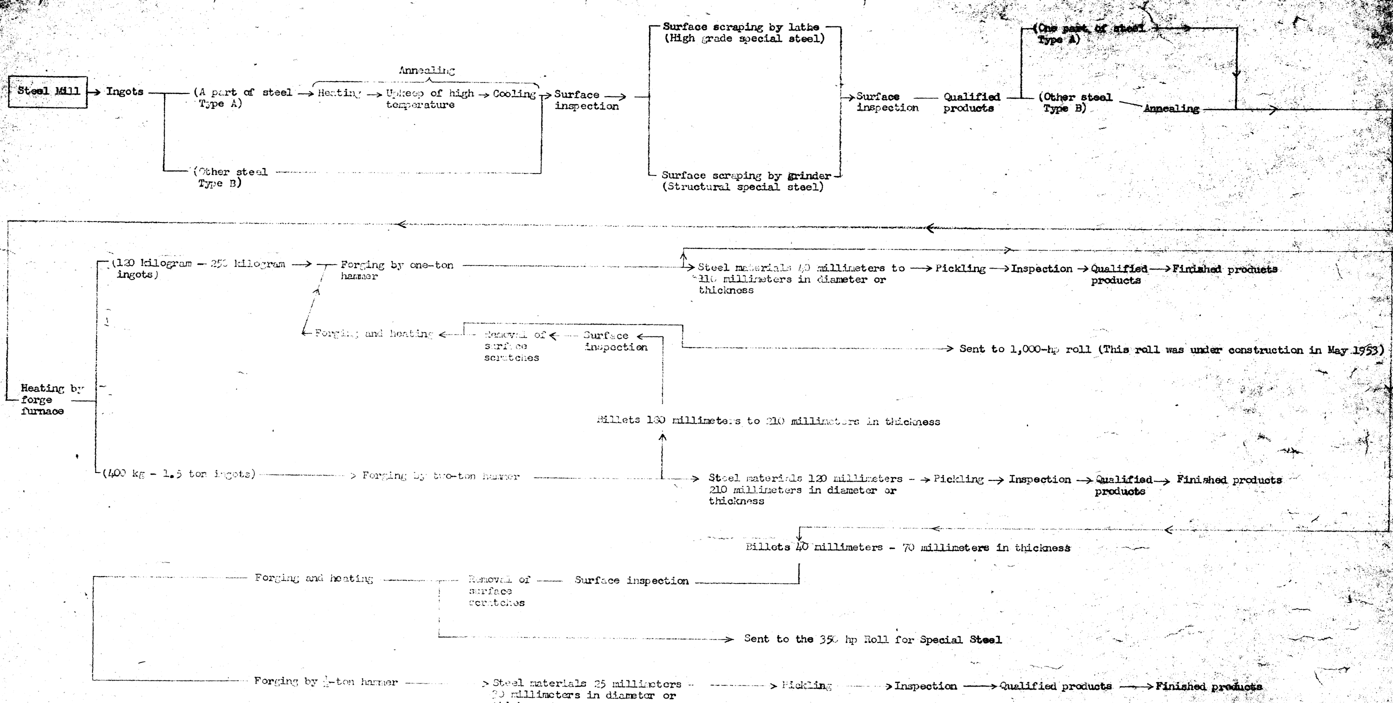
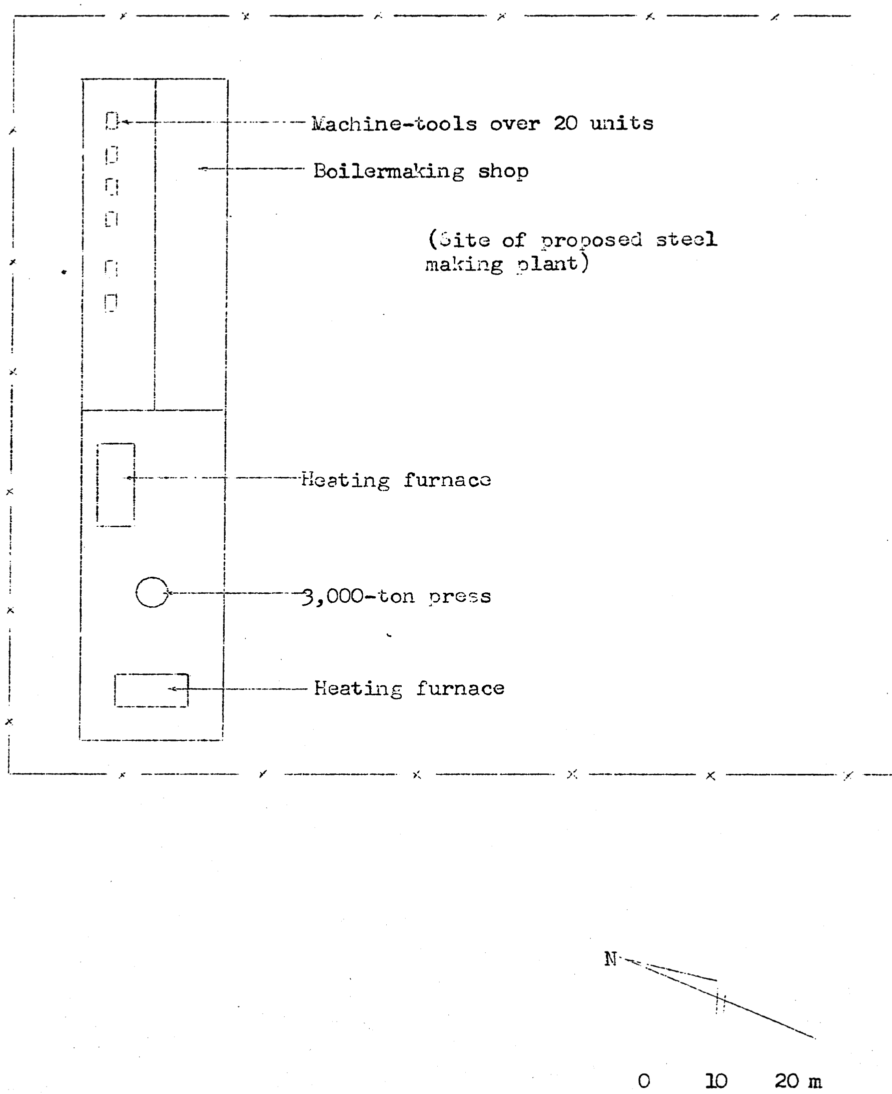
Flowchart of the Forging Plant



Doc No 90225 (13) (PB)

Chart No 13-31

Layout of Press and Boilermaking Facilities
in Machinery Plant (May 1953)



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Doc No 90225 (13) (PB)

Chart No 13-32

Shop and Equipment Layout of the Machinery Plant

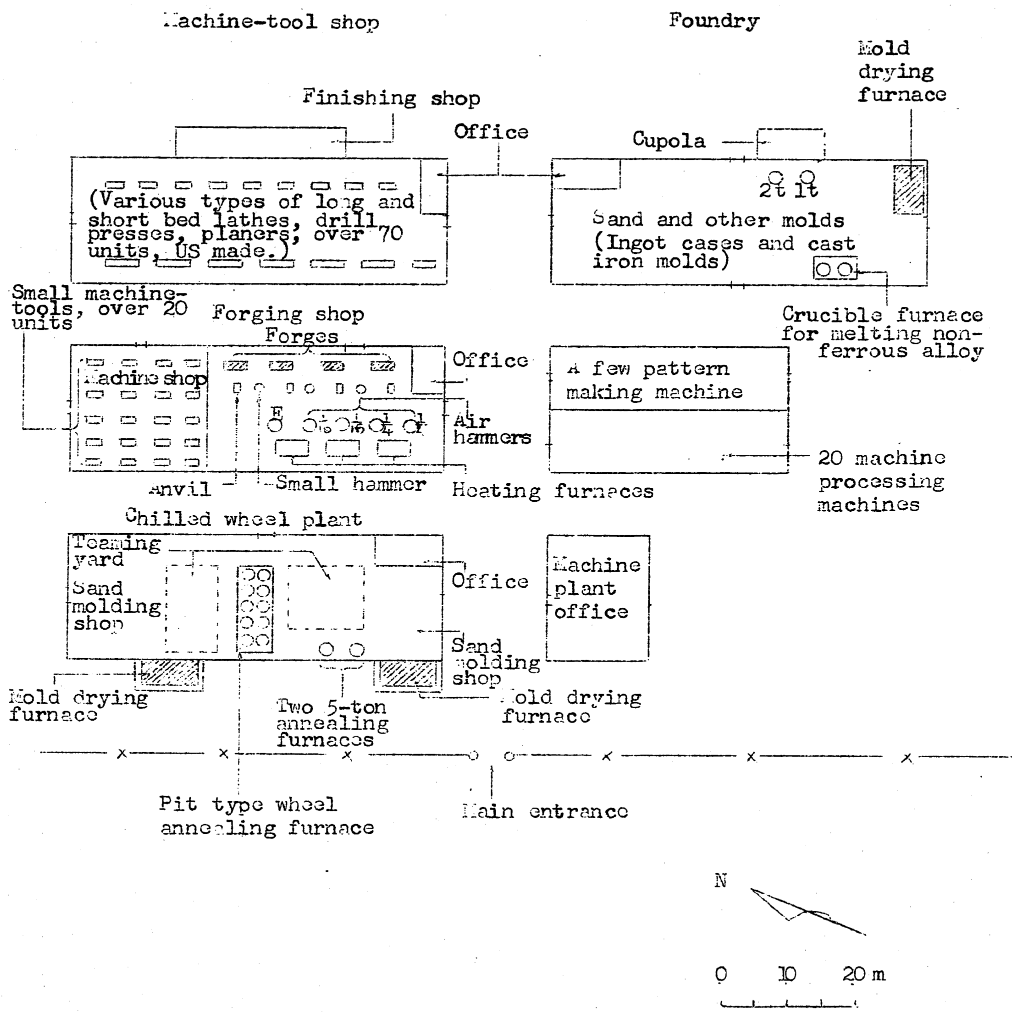

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Chart No 13-33

Operational Setup of the Machinery Plant

- Plant superintendent
  - Electricians
  - Inspectors
  - Office workers
  - Technicians
  - Engineers
  - Hydraulic press shop (person in charge) - Sections - Teams
  - Foundry (person in charge) - Sections - Teams
  - Smithy (persons in charge) - Sections - Teams
  - Machine-Tool Shop (person in charge) - Sections - Teams
  - Boilermaking Shop (person in charge) - Sections - Teams
  - Wheel chill-casting Shop (person in charge) - Sections - Teams

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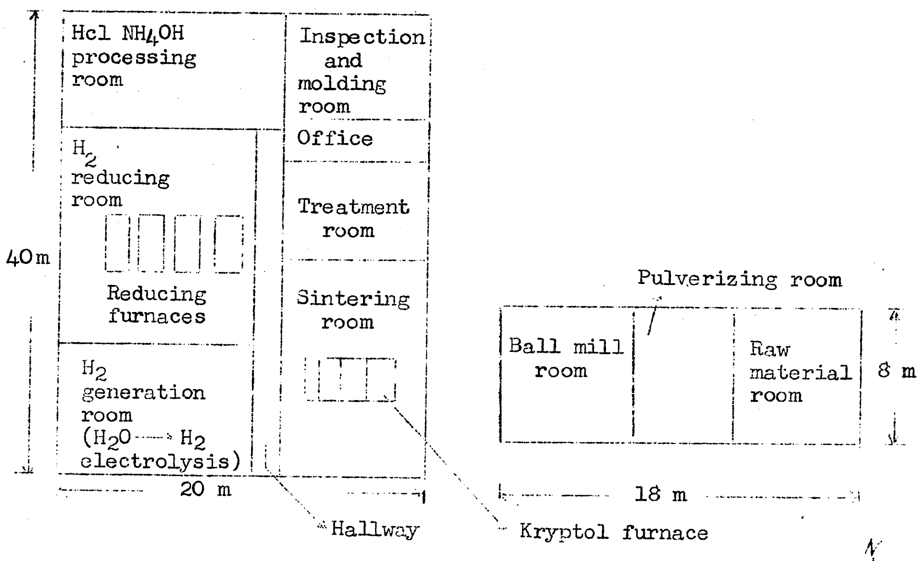
Doc No 90225 (13) (PB)

Chart No 13-34

Layout of Facilities in the Powdered Metal Alloy Plant

(About May 1953)



Doc No 90225 (13) (PB)

Chart No 13-35

Operational Setup of the Powdered Metal Alloy Plant

(May 1953)

- Plant superintendent (Assistant superintendent)
  - Technician
  - Hydrogen gas generation room
  - Inspection and molding room
  - Sintering room
  - Hydrogen gas reducing room
  - Ball mill room
  - Acid and alkali treatment room
  - Ore pulverizing room

Doc No 90225 (13) (PB)

Chart No 13-36

Flowchart of the Powdered Metal Alloy Plant

Pulverization of Tungsten ore (Pulverizing mill) → Dissolution of Hcl / Settlement of NH_4OH } done repeatedly (Acid and alkali treatment room) → Tungsten trioxide reducing furnace (Reduction of WO_3 in H_2 reducing tube) i 700° C / ii 800° C two-stage reduction → Pulverization of metallic W (ball mill) → Carbonization (C + W) (in kryptol furnaces) 1300 - 1350° C → Pulverization of WC (in ball mill) → 95 : 5 WC + Co Mixing (Ball mill)

Metallic Cobalt → in nitric acid (HN O_3) (Dissolution → Cobalt nitrate (Thermal decomposition) → Cobalt oxide → Reduction by Hydrogen → Cobalt powder → 95 : 5 WC + Co Mixing (Ball mill)

95 : 5 WC + Co Mixing (Ball mill) → Molding Shape of BAITO DAISU* → Drying → Preliminary sintering 900 - 950° C in Hydrogen → Sintering (Kryptol furnace) 1450 - 1460° C → Grinding → Finished product

Doc No 90225 (13) (PB)

Chart No 13-37

Organization of the Central China Iron and Steel Co, Ltd

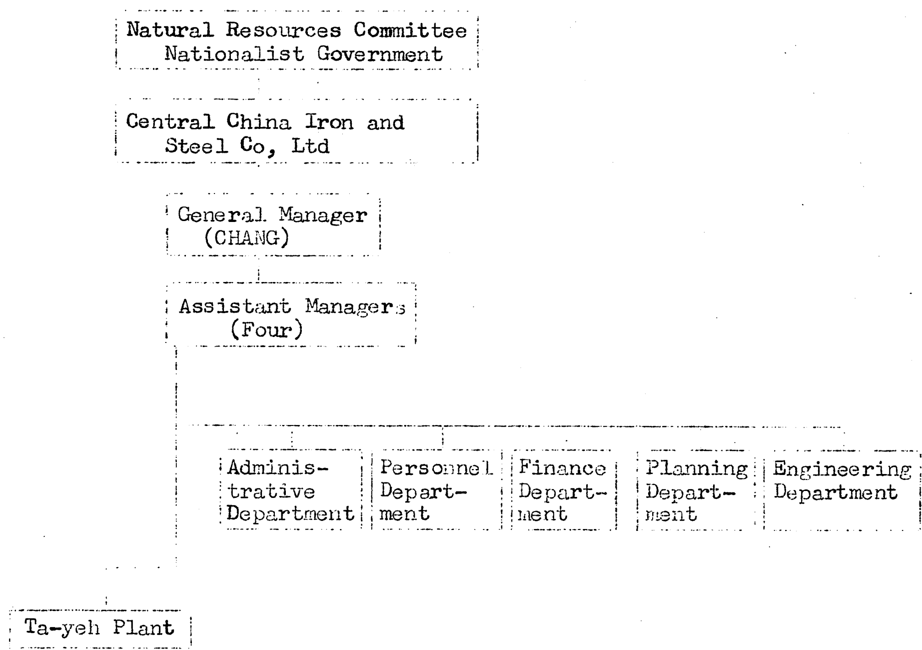
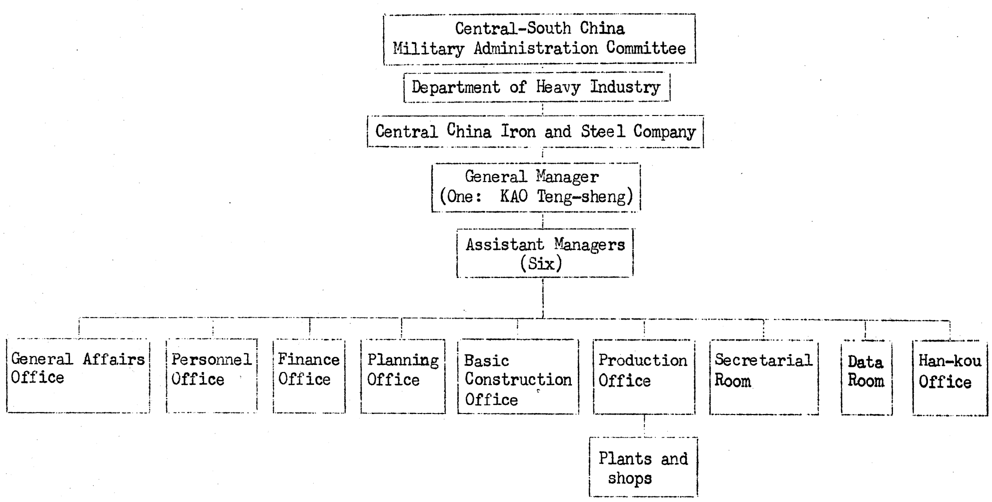


Chart No 13-38

Organization of the Central China Iron and Steel Company (April 1951)



Doc No 90225 (13) (PB)

Chart No 13-39

Organization of the Central China Iron and Steel Company

(January 1953)

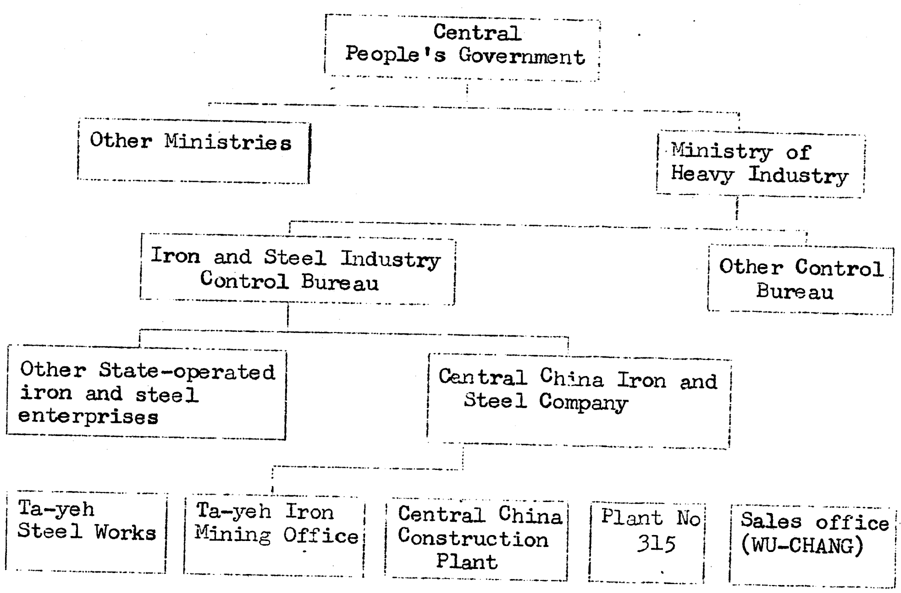


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Chart No 13-40

Organization of the Ta-yeh Steel Works

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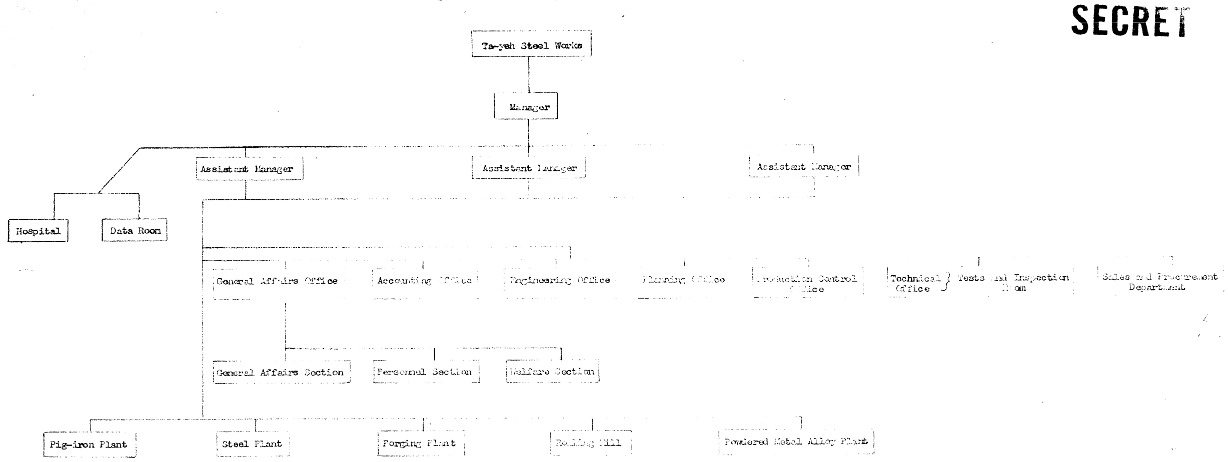

Note:
1. The managers of the Ta-yeh Steel Works is concurrently a manager of the Central China Iron and Steel Company. (At the Central China Iron and Steel Company, there are five managers working under a general manager.)
2. The assistant managers (three) of the Ta-yeh Steel Works are in charge of sales and procurement, planning and designing, and steel-making department.
3. The test and inspection room is completely equipped with facilities for chemical analysis and inspection of raw materials and products for specification.
4. The data room functions as an intelligence center dealing with matters within and without the works. The wife of the manager was in charge of the room. Various types of information and data were filed on cards.
5. The hospital was established by repairing and making use of facilities left by the Japanese. It is a general hospital with an internal medicine and surgery department, gynecology and pediatric department, X-ray department, and dental department but the facilities are inadequate.

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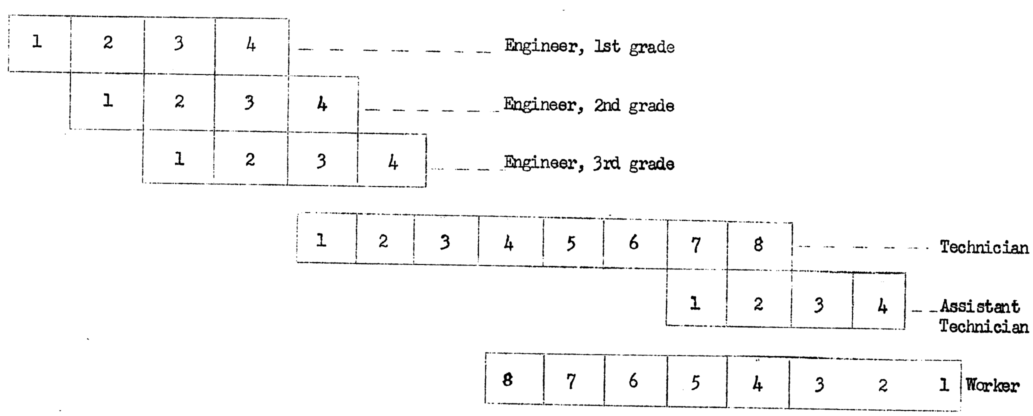
Chart No 13-41

Differences in Wage Level in the Various Positions and Steps



Doc No 90225 (13) (PB)

Chart No 13-42

Communist Party Organization Within the Ta-yeh Steel Works and Higher Echelon Organizations

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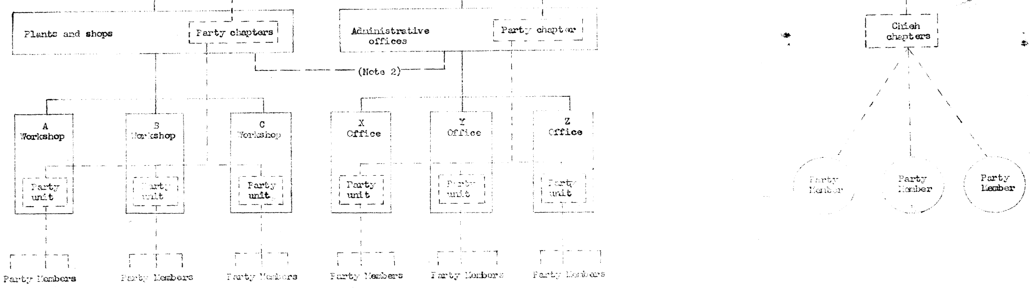

Note: 1. The manager of Ta-yeh Steel Works is KAO Teng-shen who is also the Secretary of the Huang-shih Municipal Committee of the Communist Party. Prior to this position, he was the Secretary of the Hankow Municipal Committee of the Communist Party.

2. The heads of the pig-iron and steel manufacturing plants are party members. They are, at the same time, members of the Ta-yeh Steel Works Committee of the Communist Party. Although there are relatively few party members in the administrative field, the heads of General Affairs, Finance, Production, and Planning offices belong to the party.

3. Many of the party members in the various workshops are model workers.

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Chart No 13-43

Organizational Setup of Workers' Union

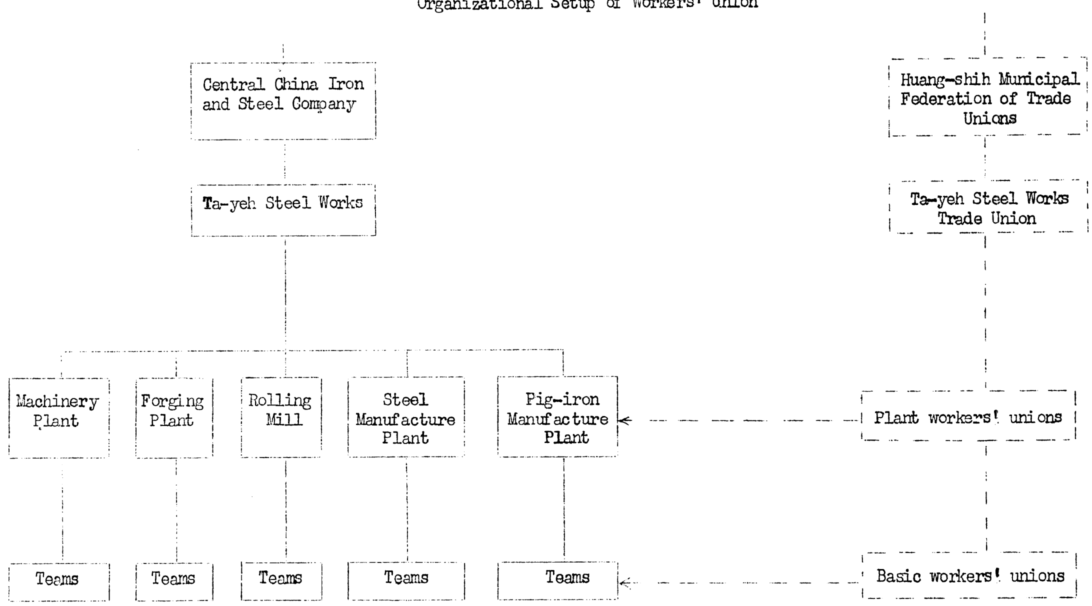

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Table No 13-1

Principal Equipment and Output of Various Products and Destination

Plant	Products	Principal equipment: Chinese Nationalist period (1946 to 1949)		Chinese Communist period (April 1951 to May 1953)		Destination
		Output	Principal facilities	Output	Principal facilities	
Pig iron plant	Low-silicon pig iron	Low-silicon pig iron: annual output, about 8,000 tons Ferromanganese: annual output, about 4,500 tons Total output: about 12,500 tons	One 30-ton small blast furnace (effective working volume, 64 cubic meters; including three latest type hot-blast stoves)	Low-silicon pig iron: annual output, about 28,000 tons	One 30-ton small blast furnace (effective working volume, 64 cubic meters)	Mainly consumed at the works for use in open-hearth furnace
Steel plant	Ordinary carbon steel Special steel Powdered metal alloy	Ordinary carbon steel: annual output, about 13,000 tons	Two 1.5-ton converters	Ordinary carbon steel: 15,000 tons (open-hearth furnace) Ordinary carbon steel: 24,[illegible]00 to 30,000 tons (converter) Various special steel: 30,000 tons Powdered metal alloy: 0.5-1 ton	One 1.5-ton open-hearth furnace Two 1.5 ton converters One 6-ton electric furnace One 3-ton " " One 1.5-ton " " One 0.5-ton alloy furnace	Open-hearth steel is shipped to market in SHANGHAI as 800-millimeter thick ingots Bessemer steel is shipped to rolling mills of the works Special steel is shipped to rolling mills and forging shop Special alloy is used as raw material for special steel
Rolling mill	Ordinary steel rolling materials (ribbed bar) (Special steel rolling	Ribbed bar (reinforcing steel): annual output, 8,400 tons	Two 600-hp rolling mills	1 Ordinary steel materials (annual output): ribbed bar, 20,000 tons 2 Special steel materials (annual output) a Case hardening steel, 20 millimeters in diameter: 2,000 tons b Structural steel, 8 to 40 millimeters in diameter: 2,5[illegible]0 tons c Nickel-chrome case hardening steel 8 to 40 millimeters in diameter: [illegible] tons d Nitriding steel, 8 to [illegible] millimeters in diameter: [illegible] tons e Heat-resisting valve steel 10 to 20 millimeters in diameter: 550 tons f High speed steel, 12 to 25 millimeters in diameter or thickness: 1,000 tons g Special tool steel, 12 to 25 millimeters in diameter or thickness: 200 tons h Carbon tool steel, 10 to 25 millimeters in diameter or thickness: 300 tons i Stainless steel, 20 to 40 millimeters in diameter or thickness: 30 tons Total: 7,290 tons	Two 600-hp rolling mills Two 350-hp rolling mills One 1,000-hp rolling mill Not put in operation in May 1953	1 Ordinary steel materials: ribbed bars are shipped to markets in [illegible] 2 Special steel materials a Case hardening steel: used by spinning plants in SHANGHAI and TIENTSIN b Structural steel: 70 per cent shipped to the Shen-yang machinery plants c Nickel-chrome steel: shipped to military plants in SHEN-YANG, HARBIN and DAIREN d Nitriding steel: same as above e Heat-resisting valve steel: same as above f High-speed steel: [illegible] per cent to [illegible], TIENTSIN, and SHANGHAI; [illegible] per cent to military plants g Special tool steel: 50 per cent to civil plants and the rest to military plants h Carbon tool steel: same as above i Stainless steel: to military plants
Forging plant	Forged special steel products	No production	No facilities	Forged special steel products 1 Structural carbon steel: 40 to 210 millimeters in diameter: about 7,500 tons 2 Nickel-chrome high tensile steel 25 to 120 millimeters in thickness: 3,000 tons 3 Spring steel 25 to 70 millimeters in thickness: 1,500 tons 4 Heat-resisting shape steel 80 to 120 millimeters in thickness: 200 tons 5 Bearing steel 12 to 80 millimeters in diameter: 500 tons Total: 12,700 tons	Two 2-ton steam hammers Three 1-ton " " Three 0.5-ton" " (One 5-ton steam hammer was under construction in May 1953 and was expected to be completed by mid-1954)	Structural steel: 70 per cent shipped to the Shen-yang machinery plants and 30 per cent to civil plants Nickel-chrome high tensile steel: shipped to military plants in SHEN-YANG, HARBIN and DAIREN Spring steel: same as above Heat-resisting shape steel: same as above Bearing steel: same as above
Machinery plant	Chilled wheels Ordinary forged products Ordinary casting	1 Chilled wheel shop: daily output of chilled wheels, 50 (products meeting specification, 60 %) 2 Casting shop: output of ordinary casting, unknown 3 Forging shop: unknown	1 Chilled wheel shop: two 5-ton cupolas 2 Casting shop: one 2-ton cupola; one 1-ton cupola 3 Forging shop: two 1/4-ton air hammers; two 1/16-ton air hammers; one electric hammer	1 Chilled wheel shop: daily output of chilled wheel, 100 (percentage meeting specification, 80 per cent) 2 Casting shop: daily output of casting, five tons 3 Forging shop: daily output of ordinary forged goods, 10 tons	1 Chilled wheel shop: two 5-ton cupolas 2 Casting shop: one 2-ton cupola; one 1-ton cupola 3 Forging shop: two 1/4-ton air hammers; two 1/16-ton air hammers; one electric hammer; others	Chilled wheel: marketed to railway plants in HANKOW and SHANGHAI Ordinary casting: sold to civilian plants

Table No 13-2

Data on the Small Blast Furnace

Rated capacity			30 tons	Working volume	63,738 cubic meters	
Throat		Type / Classification	Low silicon pig iron	Foundry pig iron	Ferromanganese	Spiegeleisen
	Gas temperature	Maximum	400°C	470°C	600°C	650°C
		Minimum	170°C	170°C	260°C	330°C
		Average	300°C	350°C	400°C	460°C
	Gas pressure	Maximum	150 millimeters (water column)	70 millimeters (water column)	160 millimeters (water column)	180 millimeters (water column)
		Minimum	70 "	30 "	45 "	60 "
		Average	90 "	55 "	90 "	100 "
Furnace body	Tuyere		Six			
	Area of tuyere		8,011 square meters			
	Diameter of cold-blast main		355 millimeters (14 inches)			
	Diameter of hot-blast main		1,000 millimeters (outside diameter)			
	Diameter of annular hot-blast main		1,000 millimeters (outside diameter)			

Table No 13-2 (Cont'd)

		SiO_2	Al_2O_3	Fe_2O_3	S. K. (Refractoriness)	Density	Porosity
Firebrick (specifications)	Throat	58 - 62	31 - 35	Greater than 4	30 - 32	2.5 - 2.8	15 - 17
	Furnace body	51 - 55	38 - 41	Greater than 0	22 - 34	2.5 - 2.9	16 - 18
	Waist	"	"	"	"	"	"
	Belly	"	"	"	"	"	"
	Hearth	"	"	"	"	"	"
	Furnace bottom	"	"	"	33 - 34	"	"
	Hot-blast stove	47 - 55	41 - 46	Greater than 3	32 - 34	2.6 - 2.9	12 - 17

Remarks:

1. Throat

   a. Normal refractoriness: 280 to 490
   b. Conductivity of heat: 10

2. Furnace body and hearth

   a. Normal refractoriness: 235 to 420
   b. Conductivity of heat: 10

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Table No 13-3

Actual Output from the Blast Furnace

Period	Classification (or daily output) / Type of pig iron	Low silicon pig iron	Ferromanganese
May 1951	Maximum	54,488 tons	19,665 tons
	Average	40 tons	15,576 tons
May 1952	Maximum	69 tons	25 tons (Manganese content: 60 - 70%)
	Average	50 tons	20 tons (same as above)
May 1953	Maximum	80 tons	Ferromanganese was not produced in the fiscal year of 1953
	Average	70 tons	
Remarks		1. The above daily output of low-silicon pig iron and ferromanganese for 1951 and 1952 represents the maximum or the average of the time when these types of products were produced alternately every three months. 2. To compute the annual output from the foregoing daily output, multiply the sum by 360, the average number of working days in a year.	

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Table No 13-4

Data on Accessory Equipment of the Small Blast Furnace

Equipment		Quantity	Type	Data	Capacity	Manufacturer	Remarks
Blower	Horizontal type	Three	Reciprocating type	Diameter of blast outlet: 914 millimeters Stroke: 457 millimeters	Blast pressure four (Kilogram/ square centi-meter Volume of blast 85 cubic meters/ second	UNITED STATES	Using three-phase induction motor 150 hp, 2960 rpm
	SANKYU TOHEISHIKI*	Two	SANKYU TOHEISHIKI*	? (TN Sic.)	Blast pressure four Volume of blast 85	? (TN Sic.)	
Hot-blast stove	Iron pipe type	Three	Iron pipe type	Total length of pipe: 343,320 millimeters Size of pipe (millimeter) Length - 3,660 Inside diameter - 200 Outside " - 250	Hot-blast Temperature of hot-blast (average) 300° C 30		
	Cowper-type	One	Cowper-type	Body (millimeter): Height - 14,400 Outside diameter - 4,000 Total heating area: 620 square meters Checkerwork type: plum flower-shaped			

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Table No 13-4 (Cont'd)

Equipment	Quantity	Type	Data	Capacity	Manufacturer	Remarks
Boiler		Lancashire type	One 150-hp steam engine	Steam pressure 120 (pound/ square meter) Revolution: 300 rpm		
Cooling system			80 cooling boxes around the furnace	Water consumption: 60 tons for every ton of low silicon pig iron and 134 tons for every ton of ferromanganese		

Table No 13-5

Chemical Composition of Coke

Composition / Area Produced	Water content	Volatile content	Fixed carbon	Ash content	Sulfur content	Absorbed moisture content
SHAO-YANG	2 - 3	3.5 - 6.7	73 - 79.5	11.5 - 17.9	0.75	6 to 10
CHUN-NAN	2.39	1.7	77.38	18.55	1.04	"
LIU-HO-KOU	1.55 - 1.91	3.02 - 3.09	72.10 - 70.25	23.37 - 23.352	0.53 - 0.57	"
TOU-LI-SHAN	-	-	81.62	11.93	0.59	"
Remarks	Coke produced in various areas is used in mixed form; therefore, the fixed carbon, ash and sulphur content is 81.79, 12.53 and 0.70, respectively. Using this type of coke in mixed form, an average of 78 tons of low-silicon iron is produced daily.					

Table No 13-6

Specifications of Limestone

Classification \ Chemical composition	Silicon dioxide (SiO_2)	Sulfur (S)	Calcium oxide (Ca O)	Granularity (millimeter)	Use (types of steel)
Calcium oxide (Ca O)	More than 4	More than 0.1	Less than 85.0	-	Special steel (electric furnace)
Calcium carbonate ($CaCO_3$)	More than 5	" " "	53 - 55	Less than 40	For open-hearth furnace
	" " "	" " "	Less than 52	25 to 30	For chilled cast wheel
	" " "	" " "	Less than 52	25 to 40	For Bessemer converter
	More than 2	More than 0.1	Less than 52	25 to 100	For blast furnace

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Table No 13-7

Amount of Raw Materials Charged to Produce One Ton of Pig Iron

Raw materials \ Type of pig iron		Foundry pig iron	Basic pig iron (open-hearth pig iron)	Ferromanganese (manganese content 70%)
Iron ore		1 ton 600 kg	1 ton 600 kg	
Manganese ore (manganese 35%)		450 kg	60 kg	3 ton 200 kg
Calcium carbonate ($Ca\ CO_3$)		450 kg	520 kg	2 ton 200 kg
Coke		1 ton 250 kg	1 ton 150 kg	3 ton 250 kg
Amount used per ton of pig iron	Water	70 tons	70 tons	218 tons
	Electric power	59 kwh	59 kwh	164 kwh

Table No 13-8

Specification of Pig Iron

Classification	Symbol	Chemical Composition							
		Silicon (Si)	Manganese (Mn)	Phosphorus (P)			Sulphur (S)		
				A	B	C	A	B	C
Basic pig iron	M 1	0.3 - 0.9	1 - 2	More than 0.20	0.21 to 0.30	0.36 to 0.75	More than 0.04	More than 0.05	More than 0.06
	M 2	0.91 - 1.20	1 - 2	More than 0.20	" " "	" " "	More than 0.04	More than 0.05	More than 0.06
	M 3	1.21 - 1.50	1 - 2	More than 0.02	" " "	" " "	More than 0.04	More than 0.05	More than 0.06
Foundry pig iron	Special 1	3.76 - 4.25	0.5 - 1.0	More than 0.10	0.11 to 0.35	" " "	More than 0.02	More than 0.03	—
	Special 2	3.26 - 3.75	" " "	More than 0.10	" " "	" " "	More than 0.02	More than 0.03	—
	1	2.76 - 3.25	" " "	More than 0.10	" " "	" " "	More than 0.03	More than 0.04	More than 0.05
	2	2.26 - 2.75	" " "	More than 0.10	" " "	" " "	More than 0.03	More than 0.04	More than 0.05
	3	1.76 - 2.25	" " "	More than 0.10	" " "	" " "	More than 0.03	More than 0.04	More than 0.05
	4	1.25 - 1.75	" " "	More than 0.10	" " "	" " "	More than 0.04	More than 0.05	More than 0.06

Table No 13-8 (Cont'd)

Classification	Symbol	Chemical Composition							
		Silicon (Si)	Manganese (Mn)	Phosphorus (P)			Sulphur (S)		
				A	B	C	A	B	C
Acid pig iron	1	1.81 - 2.20	0.5 - 1.2	More than 0.04	More than 0.06	---	More than 0.03	More than 0.05	---
	2	1.41 - 1.80	" " "	More than 0.04	More than 0.06	---	---	More than 0.05	---
	3	0.90 - 1.40	" " "	More than 0.04	More than 0.06	---	---	More than 0.05	---
Low-silicon pig iron for wheel		More than 1.00	More than 1.00		0.2 to 0.4		More than 0.10		
High-phosphorus pig iron for chilled casting		More than 1.00	More than 1.00		0.4 to 0.5		More than 0.06		

Table No 13-9

Specifications of Ferromanganese, Specular Iron, Ferrotungsten and Ferromolybdenum

Ferromanganese and Specular Iron					
Classification	Carbon (C)	Manganese (Mn)	Silicon (Si)	Sulfur (S)	Phosphorus (P)
80% Fe-Mn	5 to 7	80 ± 5	0.5 to 1.5	More than 0.03	More than 0.3
70% Fe-Mn	" " "	70 ± 5	" " "	" " "	More than 0.8
60% Fe-Mn	" " "	60 ± 5	" " "	" " "	" " "
30% Specular iron	4 to 6	30 ± 5	" " "	" " "	More than 0.5
20% Specular iron	" " "	20 ± 5	" " "	" " "	" " "

Ferrotungsten							
Symbol	C	W	Mn	Si	S	P	Specific gravity
No 1	0.5 - 1.5	75 - 80	0.5 - 1.5	More than 0.3	More than 0.1	More than 0.03	16.0 - 17.0
No 2	" " "	70 - 75	" " "	" " "	0.1	More than 0.03	15.3 - 16.0

Ferromolybdenum							
Symbol	C	Mo	Mn	Si	S	P	Specific gravity
No 1	3 - 4	50 - 60	More than 1.0	4 - 6	More than 0.1	0.05 - 0.15	8.8 - 9.10
No 2	" " "	40 - 50	" " "	" " "	" " "	" " "	8.5 - 8.80
30 x PCA	C	Mn	Si	Cr	S.P.	Spring steel (for airplanes and automobiles)	
(Cr-Mn-Si steel)	0.25 - 0.35	0.8 - 1.10	0.9 - 1.2	0.8 - 1.1	More than 0.035		

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Table No 13-10

Data on Open-hearth Furnace and Accessories

Open-hearth Furnace	
Name and type	Cold charging, stationary open-hearth furnace
Number of unit	One
Rated capacity	15 tons
Actual steel output	16 tons
Hearth area	13.72 square meters
Melting chamber volume	2.85 cubic meters
Air regenerative chamber volume	43.6 cubic meters
Gas regenerative chamber volume	26.6 cubic meters
Gas port	Incline: 7°50'; Area: 0.11 square meters; Venturi Model
Air port area	0.562 square meters
Air valve	Model: Butterfly type; Area: 0.615 square meters
Gas valve	Model: IRUMAN* type; Area: 0.508 square meters
Chimney	Height: 45 meters; Area at the base: 2.54 square meters
Average Calorific value per heat Amount of gas	1282 calories 735 square meters effective efficiency: 309
Maximum gas combustion temperature	1720° C
Maximum slag temperature	1640° C
Maximum steel bath temperature	1630° C
Maximum roof temperature	1615° C
Country of manufacture	UNITED STATES
Year manufactured	Unknown
Life	Furnace is repaired after 250 heats

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Table No 13-10 (Cont'd)

Accessories

Gas Producer	Number	Three
	Model	MONDO*
	Capacity	Seven tons
	Body	Height: 4.5 meters; Diameter: 2.44 meters
	Amount of gas produced from one ton of dry coal	3,200 cubic meters
	Average amount of coal used per hour	0.605 tons Note: Gas, 450° C; Pressure (water column), 23 millimeters; Calorific value, 1500 calories
	Gas composition	CO 27, C_2O 24, O_2 0.6, H_2 13, CH_4 4, N_2 31
	Amount of air	1257 cubic meters
Boiler	Number	Two
	Model	Vertical type, horizontal pipes
	Capacity	50 horsepower
	Body	Height, 4.42 meters; Inside diameter, 1.98 meters
Blower	Number of Unit	One
	Model	Centrifugal model
	Capacity	20 horsepower
Ladle		Two 20-ton ladles
Casting pit		Area: 4 meters by 24.2 meters
Number of plates		Nine
Size of plate		1.9 meters by 2.95 meters Note: One plate holds 36 ingots (one ingot weighs 160 kilograms)

Table No 13-11 Data on Converter (comparison with that of the Tang-shan Steel Works)

	Items \ Plants		Ta-yeh Iron and Steel Mill	Tang-shan Steel Mill (4-tons converter)
	Name		Bessemer Converter	Same as on the left
	Number		Two (Brought in from CHUNGKING by the Chinese Nationalists)	Two
	Capacity		1.5 tons	4 tons
Data (Note: See Chart No 13-11 for the letters appearing in parentheses)	Overall Height of Converter (H)	(millimeters)	2,015	2,605
	Effective Internal Height (C)	"	1,435	2,130
	Height from Furnace Bottom to Center of Tuyere (N)	"	385	550
	Inside Diameter (A)	"	780	1,150
	Same as above (m^1)	"	450	
	Same as above (m^2)	"	330	
	Same as above (B)	"	900	
	Thickness of Wall (W^1)	"	230	315
	Same as above (W^2)	"	330	
	Thickness of Bottom (v^1)	"	260	275
	Outside Diameter of Mouth (T)	"	660	880
	Inside Diameter of Mouth (E)	"	300	400
	Same as above (a)	"	250	
	Same as above (b)	"	200	
	Angle of Mouth Section (α)	(degrees)	30	41
	Same as above (β)	"	60	40
	Diameter of Tuyere (d)	(millimeters)	45	42 - 46
	Number of Tuyere		Six	Eight
	Center to Center Distance of Tuyere	(millimeters)	95	208
	Total Area of Tuyeres	(square centimeters)	95.3	122
	Angle of Tuyeres	(degrees)	8 - 10	12 - 15
	Working volume/Volume of Hot Metal Charged		3.15	8.88

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Table No 13-11 (Cont'd)

Items	Plants	Ta-yeh Iron and Steel Mill	Tang-shan Steel Mill (4-tons converter)
	Country Manufactured	UNITED STATES	
	Life	14 - 20 days from blowing out	
	Structure	See Chart No 13-11	
	Accessories		
Blower	Power Output (horsepower)	150	200
	Revolution (rpm)	2,900	2,950
	Air Pressure (Water column)	3 to 4	5
	Amount of Air (cubic meters per minute)	55 to 104	110
Remarks	The data on the 4-ton converter in the Tang-shan Steel Works are entered here for comparison.		

Table No 13-12

Data on Electric Furnaces

Furnace	Capacity	Number	Transformer Capacity	Secondary Voltage	Secondary Current	Remarks
Moore Rapid Lectromelt furnace	3 tons	One	2,000 kva (One)	220 volts 170 volts 140 volts 90 volts (Note) 4-step switch	5260 A (220 volts) 6800 A 170 volts 140 volts 90 volts	1. Made in the UNITED STATES 2. From the Nationalist period to date 3. Electrode is made of synthetic graphite, eight inches in diameter 4. With regulator 5. Was not in operation during Chinese Nationalist control
Electric Arc Furnace	6 tons	One	700 kva (One)	180 volts 140 volts	3900 A 180 volts 140 volts	Brought in from the Dairen Steel Works
Electric Arc Furnace	1.5 tons	One	280 kva (Three)	95 volts 90 volts 85 volts 80 volts (Note) 4-step switch	2100 A	Same as above
Alloy Furnace Open Model	0.5 tons	One	280 kva (Three)	95 volts 90 volts 85 volts 80 volts	2100 A	Same as above

Table No 13-12 (Cont'd)

Furnace	Capacity	Number	Transformer Capacity	Secondary Voltage	Secondary Current	Remarks
Electric Arc Furnace	3 tons	One	1,500 kva	200 volts 100 volts	3700 A (200 volts) 7400 A (100 volts)	1. Brought in from the Dairen Steel Works 2. Installed in the machinery shop
Note	As of May 1953, only 10,000 kilowatts of electric power was available to this plant. Therefore, when the 6-ton electric furnace was in operation, the operation of all other furnaces had to be suspended.					

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Table No 13-13

Data on Cupola

Principal Equipment	
Name	Cupola
Number	Three
Capacity	4 tons
Effective Height	3.5 meters
Working volume	2.747 cubic meters
Tuyere	Six
Total Area of Tuyeres	0.785 square meters
Country manufactured	JAPAN
Year manufactured	Unknown
Structure	Same as any ordinary cupola

Accessory Equipment

Blower	Type	Centrifugal type
	Number	Two
	Power Output	30 horsepowers
	Number of revolution	2,900 revolutions per minute
	Air Pressure	400 millimeters (water column)
	Amount of Air	50 cubic meters per minute

Table No 13-14

Distribution of Personnel in Steel Manufacturing Plant (May 1953)

Workshops \ Classification of Jobs	Superintendent	Assistant superintendent	Office Workers	Engineers	Technicians	Skilled Workers	Ordinary Workers	Apprentic Workers	Total
Administration Department	1	2	22			6	6		37
Open-hearth Furnace				1	6	39	87	Some	133
Converter				1	3	90	84	Some	178
Electric Furnace				1	3	99	59	Some	162
Alloy Furnace						2	4	Some	6
Steel-casting shop				1	3	39	59	Some	102
Total	1	2	22	4	15	275	299	Some	618

Note: Six each of skilled and ordinary workers directly under the administration department include blacksmith, welder, and carpenter.

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Table No 13-15

Personnel Distribution and Work Assignments in Open-hearth Furnace Shop (First half of 1953)

Name of Positions or Sections	Responsibilities	Name of Teams	Number of Personnel in each shift	Total number of Personnel for three shifts
Engineer in charge	Full responsibility over the Open-hearth furnace shop		1	1
Technicians	Responsible for technical matters concerning open-hearth furnaces		1	6
	Responsible for technical matters concerning ingot casting		1	
Transportation Section	Maintenance of transportation gathering of raw materials		Section chief: 1 Section members: 8	27
Gas Section	Maintenance of gas pipes Operation of gas produces	Gas pipe team	1	18
		Gas producer team	4	
		Boiler team	1	
Furnace Operation Section	Operation of open-hearth furnace	Furnace operation team	8	27
		Machinery team	1	
Furnace Construction Section	Maintenance of furnace construction materials	Brickwork team	2	6
Ingot Casting Section	Ingot casting	Ladle team	2	30
		Plate team	4	
		Ingot case team	2	
		Crane team	2	

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Table No 13-15 (Cont'd)

Name of Positions of Sections	Responsibilities	Name of Teams	Number of Personnel in each shift	Total number of Personnel for three shifts
Maintenance Section	Disposal of slags, and maintenance of ingots and various equipment		4	12
Working Condition	In general, the worker's attendance rate is fairly high. The rate, however, drops to about 0.85 every summer (July, August, and September) (Illness is the major cause). The major and minor repairs on open-hearth furnaces are carried out by the entire workers of the plant.			

Table No 13-16

Personnel Distribution and Work Assignment in Converter Shop (First half of 1953)

Name of Furnace	Name of Positions or Sections	Responsibilities	Name of Teams	Number of Personnel in Each Shift	Number of Personnel for Three Shifts
	Engineer in charge	Overall responsibility		1	1
	Technician	Supervision over Sections		1	3
Cupola	Raw Materials Transportation Section	Transportation of raw materials		6	18
	Raw Materials Charging Section	Charging of raw materials		6	18
	Furnace Operation Section	Works connected with tuyere, air pressure, and amount of air	Furnace Operation Team Blower Team	7	21
	Furnace Construction Section	Repairing of furnace		3	9
	Ladle Section	Operation of ladle		1	3

Table No 13-16 (Cont'd)

Name of Furnace	Name of Positions or Sections	Responsibilities	Name of Teams	Number of Personnel in Each Shift	Number of Personnel for Three Shifts
Converter	Furnace Operation Section	Blowing in ———— tapping		6	18
	Machinery Section	Operation of blower and crane	Blower Team Crane Team	2	6
	Ingot Casting Section	Manufacturing of ingots	Ladle Team	2	36
			Plate Team	8	
			Case Team	2	
	Furnace Construction Section	Remodeling repairing and pre-heating of reserve furnace	Furnace Repairing Team	2	18
		Shaping of furnace wall	Molding and Brick Team	4	
	Maintenance Section	Repairing of equipment; disposal of ingots and slags		9	27
Working Condition	This shop is narrow and is the most overworked shop in the steel manufacturing plant. For these reasons, many workers absent from their work owing to illness or overwork. In summer, the attendance rate drops to 0.7 or below sometimes.				

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Table No 13-17

Personnel Distribution and Work Assignment in Electric Furnace Shop (The first half of 1953)

Name of Positions or Sections	Responsibilities	Name of Teams	Number of Personnel in Each Shift	Number of Personnel for Three Shifts
Engineer in charge	Overall responsibility		1	1
Technicians	Supervision over sections		1	3
Raw Material Section	Drying and maintenance of {Pig iron, Ferroalloy, Lime, Pulverized coal, Iron ore}		6	18
Furnace Section	Repairing of furnace; charging → Tapping work	6-ton furnace 7 3-ton furnace 5 1.5-ton furnace 4	16	48
Machinery Section	Maintenance of transformers, electric equipments, Machine tools; operation of crane	Electricity Team	1	12
		Machine-tool Team	1	
		Crane Team	2	

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Table No 13-17 (Cont'd)

Name of Positions or Sections	Responsibilities	Name of Teams	Number of Personnel in Each Shift	Number of Personnel for Three Shifts
Ingot Casting Section	Manufacturing of ingot and preparation of ingot manufacturing	Ladle Team	4	51
		Plate Team	8	
		Case Team	5	
Furnace Construction Section	Repairing of furnaces	Brick Team	3	15
	Pulverization of raw materials and refractory materials	Pulverization Team	2	
Maintenance Section	Disposal of slags and ingots		10	30
Working Condition	The average attendance rate of workers is 0.95, but it drops to 0.85 in summer (Most of the absentees are tubercular cases)			

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Table No 13-18

Personnel Distribution and Work Assignment in Steel Casting Shop (First half of 1953)

Name of Positions or Sections	Responsibilities	Number of Personnel in Each Shift	Number of Personnel for Three Shifts
Chief	Overall responsibility	1	1
Wood pattern section	Manufacturing of wood pattern for steel casting	5	15
Moulding section	Manufacturing of sand mold and runner	15	45
Sand removing section	Removing of sand from castings	5	15
Furnace section	Operation of sand mold drying furnace and annealing furnace	2	6
Pulverization section	Operation of pulverizer	2	6
Maintenance section	Maintenance of machinery and others	6	18
Working condition	The average attendance rate of the workers is 0.97 The work in this shop is not very hard. No tubercular case was found during this period		

Table No 13-19

Specifications of Raw Materials Used for Steel Making

Composition / Material	Chemical Composition								Use
	C (%)	Mn (%)	Si (%)	P (%)	S (%)	Al (%)	Cu (%)	Granularity (millimeters)	
Pig Iron	3.5 to 4.2	0.5 to 0.9 1.0 to 2.0	1.4 to 1.8 0.8 to 1.2	More than 0.04 More than 0.03	More than 0.03 0.02				Bessemer Converter Open-Hearth Furnace
Scrap Steel	More than 0.45 More than 0.45 0.15 to 0.3	0.3 to 0.9	0.2 to 0.5	More than 0.08	More than 0.08 to More than 0.1				Bessemer Converter Open-Hearth Furnace Wheels
Fe-Mn Alloy	6 to 8 6 to 8 6 to 8	Less than 70 Less than 70 Less than 70	More than 1.0 More than 1.0 More than 1.0	More than 0.5 More than 0.5 More than 0.01	More than 0.01 More than 0.01			Less than 75 Less than 100 Less than 50	Bessemer Converter Open-Hearth Furnace Wheels

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Table No 13-19 (Cont'd)

Composition Material	Chemical Composition C(%)	Mn (%)	Si (%)	P (%)	S (%)	Al (%)	Cu (%)	Granularity (millimeters)	Use
Fe-Si	0.5 to 1.0 0.5 to 1.0 0.5 to 1.0		Less than 60 Less than 50 Less than 60					Less than 50 Less than 100 Less than 50	Bessemer Converter Open-Hearth Furnace Wheels
Low silicon Pig Iron	Less than 3.0	0.6 to 1.1	0.5 to 1.2	More than 0.5	More than 0.08		0.2 to 0.3		Wheels
Specular iron		20 to 30							Wheels
Fe-Al						Less than 98	More than 0.6		Open-Hearth Furnace Bessemer Converter

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Table No 13-20

Chemical Composition of Pig Iron
Used in Cupola and Converter

Composition \ Furnace	Cupola	Converter
C	3.8 - 4.2	3.5 - 3.8
Mn	0.8 - 1.0	0.8 - 1.0
Si	1.8 - 2.2	1.6 - 1.8
P	0.02 - 0.03	0.05 - 0.06
S	0.03 - 0.05	0.05 - 0.06
Remarks	Temperature of hot metal in converter 1,250°C - 1300°C	

Table No 13-21

Chemical Composition of Natural Silica

Source \ Composition	SiO_2	Al_3O_3	Fe_2O_3	CaO	MgO	Ignition loss
CHUNGKING	76.176	17.208	0.464	0.302	0.135	—
	68.9	23.00	0.88	0.90	Trace	6.0
SZECHWAN Province, PEI-P'EI (29°51'N, 106°23'E)	83.6	12.96	--	0.83	0.34	--
	76.54	16.31	0.3	0.07	0.26	—

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Table No 13-22

of the Amount of Raw Materials
Charged in Open-hearth Furnace

Type of Material		Charge (for 15 tons of steel)
Raw Materials	Pig iron	7 tons 500 kg
	Scrap iron	7 tons 500 kg
	Iron ore	200 kg
	Mn ore	200 kg
	Limestone	600 kg
	Mill scale	150 kg
Slagging Agents	CaO	250 kg
	CaF_2	35 kg
	Iron ore	300 kg
	Mn ore	100 kg
Deoxidizing Agents	Fe-Mn	90 kg
	Fe-Si	65 kg
	Al	2 kg
Repair Materials	MgO	110 kg
	Raw dolomite	450 kg
Remarks	This is the example when the charge is made up of pig iron 50% and scrap iron 50%.	

Table No 13-23

Example of the Principal and Secondary Raw Materials
Used in Converter to Produce One Ton of Steel

Raw Material	Amount
Pig iron	1 ton 200 kg (or 1 ton 100 kg)
Scrap iron	180 kg (or 260 kg)
Fe-Mn	10 kg
Fe-Si	4 kg
Al	0.3 kg
Na_2CO_3	8 kg
CaO	4 kg
$CaCO_3$	30 kg
Sand	30 kg
Fireproof mortar	18 kg
Raw clay	30 kg
Sleeve brick	31 kg
Stopper brick	2.5 kg
Firebrick	17 kg
Silica	30 kg
Coke	215 kg
Remarks	This is a table to determine the cost of making one ton of steel and does not necessarily show the charge alone. Recoverable waste (44 kg) is also produced.

Table No 13-24

Example of the Amount of Raw Materials Charged in Electric Furnace to Produce One Ton of Steel

Type of steel	Principal components(%)	Raw materials charged (kg) to produce one ton of steel												
		Scrap iron (Molten steel)	Low P pig iron	CaO	CaF_2	Iron ore	Fe-Mn (Mn-70)	Fe-Si (Si 70)	C powder	Al	Fe-Cr (Cr 80)	Ni	Fe-W (W 65)	Fe-V (V 40)
Case hardening carbon steel	C 0.12-0.18	1,100	-	90	17	27	6.5	3	5	0.6	-	-	-	-
Case hardening Ni-Cr steel	C 0.07-0.14 Cr 1.15-1.25 Ni 3.75-4.25	1,050	-	104	22	35	7	8	3	1.2	16	40	-	-
Ni-Cr-W high tensil steel	C 0.15-0.22 Cr 1.3-1.5 Ni 4.0-4.5 W 0.8-1.2	1,040	-	112	25	35	12	6	3	2.2	18	43	14	-
Si-Mn-Cr spring steel	C 0.35-0.42 Mn 0.5-0.9 Si 1.0-1.3 Cr 1.0-1.5	1,100	-	100	19	30	6	6	5	0.5	16	-	-	-
Bearing steel	C 1.0-1.15 Cr 1.4-1.6	900	200	100	21.5	30	3.5	6	8.5	0.6	19	-	-	-
Heat resisting steel	C 2.0-2.2 Cr 11.5-12.5	700	250	93	20.5	30	5	4.6	7	0.5	150	-	-	-
High-speed steel	C 0.7-0.8 W 17-18.5 Cr 3.8-4.5 V 0.8-1.3	580	150	102	23	21	-	12	6.5	0.6	60	-	280	28
Remarks	Molten steel used as raw material is obtained by first melting a charge composed of 90% low phosphorus pig iron and 10% scrap iron in cupola and then blowing the molten metal in a converter till its carbon content reaches 0.4 - 0.5 per cent.													

Table No 13-25

Description of Soviet Symbols for Special Steel

Symbol	Explanation
A	(High grade carbon steel) S < 0.03% P < 0.035% S + P < 0.069 Examples: 30A means high-grade steel containing 0.25 - 0.35% C 25A " " " " " 0.20 - 0.30% C
CT	(Carbon steel) Example: CT 30 means it contains 0.25 - 0.35% C
У	(Carbon tool steel) Examples: Figures following У indicate carbon content У9 means 0.86 - 0.94% C
X	(Cr) Examples: The letter X alone means it contains 0.6 - 0.9% Cr or 0.8 - 1.2% Cr X2 means 1.3 - 1.7% Cr X12 means 11.5 - 13% Cr
H	(Ni) Examples: H -- 1.7 - 2.3% Ni H3 -- 2.75 - 3.25% Ni H4 -- 3.75 - 4.25% Ni H alone sometimes also means 4% Ni
Г	(Mn) Steel without the letter Г means it contains 0.25 - 0.45% Mn Steel with the letter Г means it contains 0.8 - 1.2% Mn
B	(W) In the case of structural steel, 0.8 - 1.2% W

Table No 13-25 (Cont'd)

Symbol	Explanation
M	(Mo) In the case of structural steel, 0.25 - 0.45% Mo or 0.15 - 0.25% Mo
Φ	(V) In the case of structural steel, 0.1 - 0.2% V or 0.2 - 0.4% V
Ю	(Al) In the case of structural steel, 0.7 - 1.3% Al
C	(Si) In the case of structural steel, 0.9 - 1.2% Si or 2 - 2.3% Si
IIIX	Bearing steel (High carbon chromium steel) Example: IIIX 6 - 15 indicates % of Cr
ЭЖ	Stainless steel (High Cr)
ЭЯ	Stainless steel (18 - 8 Cr - Ni type steel)
K	(Co) Examples: PK 5 . P means high-speed steel, K5 means 5% Co, so PK5 means high-speed steel with 5% Co PΦ 2 means high-speed steel containing 2% V
ЭИ	Low - W high-speed steel
BK	Hard (powdered) alloy steel
T	(Ti)

Table No 13-26

Mechanical Properties of A-Type Ordinary Carbon Steel

Symbol	Mechanical Properties			
	Tensile Strength σ B** kg/mm^2	δ (%)** Elongation		σ 5** kg/mm^2 (minimum)
		δ 10** (minimum)	δ 5** (minimum)	
(PC 0) CTO 0**	< 50	-	-	-
CT 0**	32 - 47	18	22	19
(PC 1) CT 1**	32 - 40	28	33	-
CT 2**	34 - 40	23 - 26	27 - 31	22
CT 3**	41 - 47	21 - 22	25 - 26	24
CT 4**	45 - 53	17 - 20	21 - 24	26
CT 5**	54 - 63	13 - 16	15 - 20	28
CT 6**	67 - 74	9 - 12	11 - 14	31
CT 7**	75 - 85	7 - 8	8 - 10	-

Table No 13-27

Chemical Composition of B-Type Ordinary Carbon Steel

Symbol	Chemical Composition						
	C	Mn	Si			S (minimum)	P (minimum)
			Rimmed Steel	Semi-Killed Steel	Killed Steel		
Ordinary Open-Hearth Carbon Steel							
MCT 0**	< 0.23	-					
" 1**	0.07 - 0.12	0.35 - 0.50	Trace	≤ 0.16	0.17 - 0.35	0.060	0.070
" 2**	0.09 - 0.15	"	"	"	"	0.055	0.050
" 3**	0.14 - 0.22	0.40 - 0.65	"	"	"	"	"
" 4**	0.18 - 0.27	0.40 - 0.70	"	"	"	"	"
" 5**	0.28 - 0.37	0.50 - 0.80	-	"	"	"	"
" 6**	0.38 - 0.50	"	-	"	"	"	"
" 7**	0.50 - 0.63	0.55 - 0.85	"	"	"	"	"
Ordinary Bessemer Carbon Steel							
BCT 0**	< 0.14	-				0.080	0.085
" 3**	< 0.12	0.25 - 0.55	Trace	≤ 0.16	0.17 - 0.35	0.065	"
" 4**	0.12 - 0.20	0.35 - 0.55	"	"	"	"	"
" 5**	0.17 - 0.30	0.50 - 0.80	"	"	"	"	"
" 6**	0.26 - 0.40	0.80 - 0.90	"	"	"	"	"

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Table No 13-28

Chemical Composition of High-grade Carbon Steel (mostly Electric Steel)

Symbol	Chemical Composition						
	C	Mn	Si	S (maximum)	P (maximum)	Ni (maximum)	Cr (maximum)
08	0.05 – 0.12	0.25 – 0.50	≤ 0.05	0.040	0.040	0.30	0.15
15	0.10 – 0.20	0.35 – 0.65	0.17 – 0.37	0.045	0.045	"	0.30
25	0.20 – 0.30	0.50 – 0.80	"	"	"	"	"
35	0.30 – 0.40	"	"	"	"	"	"
45	0.40 – 0.50	"	"	"	"	"	"
55	0.50 – 0.60	"	"	"	"	"	"
15P	0.10 – 0.20	0.70 – 1.00	0.17 – 0.37	"	"	"	"
20P	0.15 – 0.25	"	"	"	"	"	"
30P	0.25 – 0.35	"	"	"	0.040	"	"
40P	0.35 – 0.45	"	"	"	"	"	"
50P	0.45 – 0.55	"	"	"	"	"	"
60P	0.55 – 0.65	"	"	"	"	"	"
7	0.60 – 0.75	≤ 0.4	≤ 0.35	0.04	"	0.25	0.20
8	0.75 – 0.85	"	"	"	"	"	"
9	0.86 – 0.94	≤ 0.35	"	"	"	"	"
10	0.96 – 1.09	< 0.31	"	"	"	"	"
12	1.10 – 1.25	"	"	"	"	"	"
13	1.26 – 1.40	≤ 0.40	"	"	"	"	"
8TA	0.80 – 0.90	0.35 – 0.60	"	0.03	0.03	"	0.30
9PA	0.90 – 1.10	0.30 – 0.60	0.15 – 0.35	0.02	"	–	–

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Table No 13-29

Soviet Specifications for High-grade Carbon Steel

Symbol	C	Si	Mn	P	S	Ni	Cr
2 C 08	0.05 - 0.12	< 0.03	0.05 - 0.50	≤ 0.040	< 0.040	< 0.30	< 0.15
" 10	0.05 - 0.15	0.17 - 0.37	0.35 - 0.65	< 0.045	< 0.045	"	"
" 15	0.10 - 0.20	"	"	"	"	"	< 0.30
" 20	0.15 - 0.25	"	"	"	"	"	"
" 25	0.20 - 0.30	"	0.50 - 0.80	"	"	"	"
" 30	0.25 - 0.35	"	"	"	"	"	"
" 35	0.30 - 0.40	"	"	"	"	"	"
" 40	0.35 - 0.45	"	"	"	"	"	"
" 45	0.40 - 0.50	"	"	"	"	"	"
" 50	0.45 - 0.55	"	"	"	"	"	"
" 55	0.50 - 0.60	"	"	"	"	"	"
" 60	0.55 - 0.65	"	"	"	"	"	"
2 C 15 Mn	0.10 - 0.20	"	0.70 - 1.00	"	"	"	"
" 20 "	0.15 - 0.25	"	"	"	"	"	"
" 30 "	0.25 - 0.35	"	"	< 0.040	"	"	"
" 40 "	0.35 - 0.45	"	"	"	"	"	"
" 50 "	0.45 - 0.55	"	"	"	"	"	"
" 60 "	0.55 - 0.65	"	"	"	< 0.040	"	"

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Table No 13-30

Soviet Specifications

WC Powdered Metal Alloy (Hard alloy)

Symbol	Chemical Composition		Bending strength Kg/mm^2	Specific gravity	Hardness (HRA)(Rock-wells' hardness Scale A)
	WC	Co			
BK 3	97	3	100	14.9	89
BK 6	94	6	120	14.5	88
BK 8	92	8	130	14.35	87.5
BK 10	90	10	135	14.20	87

Soviet Specifications for Chemical Compositions of Stainless and Heat-resisting Steels

Symbol	C %	Mn %	Si %	S %	P %	Cr %	Ni %	
ЭЖ 1	≤ 0.14	≤ 0.50	≤ 0.70	≤ 00.35	≤ 0.035	12.50 - 14.50	≤ 0.60	Stainless Steel
ЭЖ 2	0.15 - 0.25	"	"	"	"	"	"	" "
ЭЖ 3	0.24 - 0.35	≤ 0.75	"	≤ 0.030	≤ 0.030	"	"	" "
ЭЖ 4	0.35 - 0.45	"	"	"	"	12.00 - 14.00	"	" "
D) ЭСХ 8	0.35 - 0.50	"	2.00 - 3.00	"	"	8.00 - 14.00	"	Heat resisting steel (800° C)
ЖН 60	≤ 0.25	0.70 - 1.5	0.50 - 1.20	≤ 0.020	"	14.00 - 18.00	550 - 610 (TN Sic.)	
A) ЭУ 100	0.15 - 0.25	7.00 - 10.00	≤ 0.90	≤ 0.030	≤ 0.030	12.00 - 14.00	3.80 - 5.00	
B) ЭУ 107	0.35 - 0.45	0.30 - 0.40	1.90 - 2.60	≤ 0.030	≤ 0.030	9.00 - 10.50	≤ 0.50	
E) ЭУ 181	≤ 0.25	≤ 0.90	≤ 1.20	≤ 0.030	≤ 0.035	23.00 - 27.00	≤ 0.60	
C) Э 917	≤ 0.12	≤ 1.5	≤ 1.0	≤ 0.020	≤ 0.030	17 - 20	9 - 11	

Present use of Soviet steel

1. A) is substituted for C).
2. B) is used for aircrafts' and high-class automobiles' valves.
3. C) is an acid-proof steel and is used for the side walls of important parts of aircrafts, warships and others. Also, it is used for welded pipes and other household furnitures.
4. D) is a heat resisting steel and is used for parts subject to heat of about 800 degrees centigrade.
5. E) is used as heat and gas resisting materials.

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Soviet Specifications for Chemical Compositions of Special Steel (1)

Type of steel	Symbol	C %	Si %	Mn %	P %	S %	Ni %	Cr %	V %	Mo %	Al %	W %
Structural carbon steel	08A	0.05 - 0.12	≤ 0.05	0.25 - 0.50	≤ 0.035	≤ 0.035	≤ 0.3	≤ 0.15				
	10A	0.05 - 0.15	0.17 - 0.37	0.35 - 0.65	"	≤ 0.03	"	"				
	20A	0.15 - 0.25	"	"	"	"	"	≤ 0.3				
	45A	0.40 - 0.50	"	0.50 - 0.80	"	"	"	"				
Carbon tool steel	Y7A	0.60 - 0.74	< 0.30	0.25 - 0.35			≤ 0.25	≤ 0.20				
	Y9A	0.85 - 0.94	"	"			"	"				
	Y10A	0.95 - 1.04	"	"			"	"				
	Y12A	1.10 - 1.25	"	0.15 - 0.25			"	"				
Special tool steel	Ф	0.85 - 1.05	≤ 0.35	0.20 - 0.40					0.20 - 0.40			
	X8	1.30 - 1.50	"	0.45 - 0.70				1.30 - 1.60				
Die steel	X12	2.0 - 2.3	≤ 0.40	≤ 0.35			≤ 0.35	11.5 - 13.5				
	X12M	1.45 - 1.7	"	"			"	11.0 - 12.5	0.15 - 0.30	0.5 - 0.8		
Bearing steel	X	0.95 - 1.10	≤ 0.35	≤ 0.40				1.3 - 1.6				
Heat-resisting steel	CXS	0.35 - 0.57	2.2 - 3.2	0.3 - 0.7	≤ 0.03	≤ 0.02		8.4 - 9.5				
High-speed steel	PФ	0.70 - 0.80	≤ 0.40	≤ 0.40	≤ 0.035	≤ 0.035	< 0.40	3.8 - 4.6	1.0 - 1.4	≤ 0.30		
	ЭИ 262	0.85 - 0.95	≤ 0.45	≤ 0.45	"	"		4.0 - 4.6	2.0 - 2.6			
Spring steel	37XCT	0.35 - 0.42	0.50 - 0.90	1.0 - 1.3	≤ 0.03	≤ 0.03	≤ 0.40	1.0 - 1.5				
	37XC	0.32 - 0.40	1.00 - 1.30	0.30 - 0.50	≤ 0.035	≤ 0.035	"	1.3 - 1.8				
Case-hardening steel	12XH3A	0.11 - 0.17	0.18 - 0.35	0.18 - 0.60	"	"	2.75 - 3.25	0.60 - 0.90				
	12XH4A	"	"	"	"	"	3.25 - 3.75	"				
	12X2H4A	"	0.17 - 0.37	"	"	"	3.25 - 3.75	1.25 - 1.75				
Nitriding steel	38XM ЮA	0.35 - 0.42	"	"	"	"	≤ 0.40	1.35 - 1.65		0.15 - 0.25		
High tensile steel	38XA	0.34 - 0.42	"	0.50 - 0.80	≤ 0.03	≤ 0.03	≤ 0.30	0.80 - 1.10				
	30XH3	0.25 - 0.35	"	0.30 - 0.60	"	"	2.75 - 3.25	0.60 - 0.90				
	20X2H4A	0.15 - 0.22	"	0.25 - 0.55	≤ 0.035	≤ 0.035	4.10 - 4.60	1.35 - 1.65		(0.25 - 0.45)	or (0.8 - 1.2)	
	30XH2M ФA	0.26 - 0.33	"	0.30 - 0.60	"	"	2.00 - 2.50	0.60 - 0.90	0.15 0 0.30	0.20 - 0.30		
	18XHBA	0.15 - 0.22	"	0.25 - 0.55	"	"	4.0 - 4.5	1.35 - 1.65		(0.25 - 0.45)	or (0.8 - 1.2)	
	25XHBA	0.21 - 0.28	"	"	"	"	4.0 - 4.5	1.35 - 1.65				0.8 - 1.2
Stainless steel	ЭУ 100	0.15 - 0.25	< 0.90	7.00 - 10.00	7.00 - 10.00	≤ 0.030	3.30 - 5.00	12.00 - 14.00				
	ЭУ 107	0.35 - 0.45	1.90 - 2.60	0.30 - 0.40	"	"	≥ 0.50	9.00 - 10.50				
	ЭУ 917	≤ 0.12	≤ 1.0	≤ 0.15	≤ 0.030	≤ 0.020	9.0 - 11.0	17.0 - 20.0				
	ЭУ 181	≤ 0.25	≤ 1.20	≤ 0.80	≤ 0.035	≤ 0.030	≤ 0.60	23.0 - 27.0				

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Soviet Specifications for Special Steel (2)

Symbol	Size	C %	Si %	Mn %	P %	S %	Ni %	Cr %	V %	Mo %	Al %	W %
[illegible]	15 Ф ** - 200 Ф **	.15 - .22	.17 - .37	.25 - .55	≤ .035	< .035	4.1 - 4.6	1.35 - 1.65	-----	.25 - .45		0.8 - 1.2
[illegible]	100 Ф ** - 200 Ф **	.32 - .40	1.00 - 1.30	.30 - .50	"	"	≤ .40	1.30 - 1.8	-----			
[illegible] A	60 - 150 Ф **	.11 - .17	.17 - .37	.30 - .60	"	"	3.25 - 3.75	1.25 - 1.75				
[illegible] Ф A	23 Ф ** - 670	.26 - .33	.17 - .37	.30 - .60	"	"	2.00 - 2.50	.60 - .90	.15 - .30	.20 - .30		
[illegible] Ю A	40 - 150	.35 - .42	.17 - .37	.30 - .60	"	"	≤ .4	1.35 - 1.65	-----	.15 - .25	0.7 - 1.1	
[illegible]	18 Ф ** - 272	.35 - .57	2.2 - 3.2	.3 - .7	< .03	< .02	-----	8.4 - 9.5				
[illegible] 262	5 - 100	.85 - .95	≤ .45	≤ .45	< .035	< .035	-----	4.00 - 4.6	2.0 - 2.6	-----	-----	8.5 - 10.00
[illegible]	10 - 55	.7 - .80	≤ .4	≤ .4	"	"	< .4	3.8 - 4.6	1.0 - 1.4	≤ .3		17.5 - 19.0
X12M2	100 - 100 (TN Sic.)											
X12M		1.45 - 1.7	≤ .4	≤ .35			.35	11.0 - 12.5	.15 - .30	0.5 - 0.8		
X-12		2.0 - 2.3	"	"			"	11.5 - 13.5				
XГ	10 - 40 Ф **	1.3 - 1.5	≤ .35	.45 - .70				1.3 - 1.6				
X	Bearing	.95 - 1.10	≤ .35	≤ .40				1.3 - 1.6				
CT35XTCA		.32 - .39	1.10 - 1.40	.80 - 1.10			≤ .40	1.10 - 1.40				
10A	8 - 180	.05 - .15	.17 - .37	.35 - .65	< .035	< .3	≤ .3	≤ .15				
20A	60 - 150	.15 - .25	"	.35 - .65	< .035	< .03	≤ .3	≤ .3				
40A	10 - 60	.35 - .45	"	.5 - .8			"	"				
45A	6 - 210	.40 - .50	≤ .35	"			"	"				
(50A) Ф	10 - 60	.85 - 1.05	≤ .35	.2 - .4					.2 - .4			
12XH3A	16 - 100	.11 - .17	.18 - .35	.3 - .6			2.75 - 3.25	.60 - .90				
12XH4A	45 - 80	"	"	"			3.25 - 3.75	"				
12X2H4A	25 - 120 Г **	"	.17 - .37	.3 - 0.6			3.25 - 3.75	1.25 - 1.75				
30XTCHA	60 - 120											
38XMЮA												
Y7A	8 - 130	.6 - .74	1.3	.25 - .35			≤ .25	≤ .2				
Y8A	10 - 100	.75 - .85	"	"			"	"				
Y9A	10 - 100	.85 - .94	"	"			"	"				
Y10A	60 - 140	.95 - 1.04	"	"			"	"				
Y12A	12 - 15	1.10 - 1.25	"	.15 - .25			"	"				
65 Г	50 - 80	.60 - .75	.17 - .35	.90 - 1.20			< .3	≤ .3				
25XHBA	20 x 20	.21 - .28	.17 - .37	.25 - .55			4.0 - 4.5	1.35 - 1.55				
30XHB	28 x 28	.25 - .35	"	.30 - .60			2.75 - 3.25	.6 - .9				
35XH3TA	6 x 35											
CT35XTCA	30 x 35	.32 - .39	1.10 - 1.40	.80 - 1.10			≤ .40	1.10 - 1.40				
CT30XH3	Ф ** 52	.25 - .35	.17 - .37	.30 - .60			2.75 - 3.25	.60 - .90				
35XA	XH3M**,X		35X ; T**	CA								
45X	20 - 50	.40 - .50	.17 - .30	.50 - .80	.04	.04	.30	.80 - 1.10				
38XA	15 - 30	.34 - .42	.17 - .37	.50 - .80	.03	.03	.30	.80 - 1.10				
12XH3A	30 - 150	≤ .17	.17 - .37	.50 - 5.5 (TN Sic.)	.035	.035	2.75 - 3.25	.60 - .90				
13X2A												
12X2H4A												
18XHBA	15 - 200	.15 - .22	.17 - .37	.25 - .55	< .035	< .035	4.10 - 4.60	1.35 - 1.65		(.25 - .45)	or	(.8 - 1.2)
20X2H4A		"	"	.3 - .6	"	"	3.25 - 3.75	1.25 - 1.75				
65 Г		.60 - .75	.17 - .34	.90 - 1.20			.30	.30				
18XHBA		.15 - .22	.17 - .37	.40 - .55	.03	.03	4.0 - 4.5	1.3 - 1.6				.8 - 1.2
X12		2.0 - 2.2	.17 - .37	.40 - .45	"	"		11.5 - 12.5				

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Table No 13-33

Soviet Specifications for Special Steel (3)

Symbol	Type of Steel	Quenching temperature	Medium	Tempering	Medium	Mechanical Properties				
						σ_B**	δ**	Cr	A	HB
10A	Carbon structural steel					Tensile strength	Elongation	Reduction of area	(Shelby Impact)	Brinell hardness
20A	"					(kg/mm²)	(%)	(%)	(Mkg/cm²)	
40A	"	860	Water	600		>57	>18	>45	>6	
45A	"	850	"	600		>60	>16	>42	>5	
50A	"	840	"	600		>63	>14	>40	>4	
У7A	Carbon tool steel	800 - 830	"	200 - 320						>480
У8A	"	790 - 820	"	"						>500
У9A	"	780 - 810	"	"						>550
У10A	"	770 - 800	"	"						>600
У12A	"	760 - 790	"	"						>600
38XA	Cr steel	860	Oil	550	Water Oil	>95	>12	>50	>9	
45X	"	840	"	500	"	>105	>8	>40	>5	
13XH2A	Ni-Cr case hardening steel									
12XH3A	"	860 - 780	Oil	150	"	>95	>11	>55	>9	

Table No 13-33 (Cont'd)

Symbol	Type of Steel	Quenching temperature	Medium	Tempering	Medium	Mechanical Properties				
						σ B**	δ**	Cr	A	HB
12XH4A	Ni-Cr case hardening steel	880 - 780	Oil	200	Air	>110	>10	> 50	> 9	
12X2H4A	——— " ———	880 - 780	"	200	"	>110	>10	>50	>9	
2CX2H4A	——— " ———	880 - 780	"	200	"	>120	> 9	> 45	> 8	
CT30XH3	Ni-Cr steel	820	"	530	Water Cr Oil	>110	> 9	> 45	> 8	
25XHBA	High power Ni-Cr-W steel	780 - 850	Air			>160	> 7	> 25	> 5	> 440
18XHBA	(Above 400 hp Airplane crank shaft)	840 - 860	Oil	600	Oil	> 120	>12	>35	> 10	> 300
CT30XH2M Φ A	Ni-Cr-Mo-V Steel	820 - 840	"	550	"	>100	>17	> 40	> 8	> 240
38XMЮA	Cr-Mo-Al steel	840 - 860	"	600	Air	> 95	>18	>50	> 5.5	> 250
Φ	V Tool steel	780 - 820	"	220 - 260						> 62RC
65 Г	Mn steel	800 - 840	"	400 - 450		>115	>12	> 20		
X12	Die steel	950 - 1000	"	400 200 - 260						> 60RC
X	Ball bearing steel	830 - 860	"	200 - 260						> 62RC
X Г	"	800 - 830	"	200 220 - 260						> 61RC
X12M	"	950 - 1000	"	400 200 - 260						> 58

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Table No 13-33 (Cont'd)

Symbol	Type of Steel	Quenching temperature	Medium	Tempering	Medium	Mechanical Properties				
						[illegible]B**	[illegible] **	Cr	A	HB
2 И 262	Low high-speed steel	X - X**	O**	560						62 - 65 RC
CX8	Heat-resisting steel	850 - 950	Oil	650 - 750		>95	>15	>35		>270
CT35XPCA	Si-Mn-Cr spring steel	860	"	450		>140	>13	>3		>400
PФ		1250	"	580						>640
37XC	Cr-Si spring steel	900	"	630	Oil	>90	>12	>50	>7	

Note: X - X** 1240 (Complex tool steel O** quenched in oil)
1250 (Simple tool steel, quenched in KNO_3 /potassium nitrate/ solution of 450 to 600 degrees centigrade to within 20 degree centigrade above and below that temperature)
RC = Rockwell scale C

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Table No 13-34

Soviet Sizes of Special Steel Materials

10A	- 8, 10, 12, 14, 16, 20, 25, 30, 40, 55, 60, 65, 70, 75, 80, 90, 100, 110, 120, 130, 140, 150, 150 Φ
20A	- 60, 70, 80, 95, 110, 130, 150 Φ
30A	- 10, 12, 14, 20, 30, 35, 40, 50, 60 Φ
45A	- 6, 10, 12, 16, 18, 20, 22, 25, 28, 30, 35, 40, 50, 55, 60, 65, 70, 80, 90, 100, 120, 135, 150, 190, 210 Φ
CT50	- 8 Φ **, 24, 100 Φ
У7A	- 8 = 130
У8A	- 10 Φ = 100
У9A	- - " -
У10A	- 12 = 140 Φ
У12A	- 12 = 100 Φ
65T	- 50, 60, 80 Φ
XT	- 10 = 40 Φ
X12	- 20, 40, 60, 80 Φ
X	- 40 Φ
45X	- 20, 30, 50
38XA	- 15, 30 Φ, X13X2A 100, 35XA, 40
CX8	- 18 X, XIII

Table No 13-34 (Cont'd)

Soviet Sizes of Special Steel Materials

37XC	- 100, 150, 200 Φ
X12M	- 5, 8, 10, 12, 16, 18, 20, 25, 30, 35, 40, 50 Φ
CT30XH3	- 52 Φ , 30 Φ , 50 Φ , 11 Φ
12XH3A	- 30, 50, 60, 100, 150 Φ
12X2H4A	- 60, 100, 150
20X2H4	- 50, 100, 150, 200
XH3M	- 190
CT30XH2M Φ A**	- 23, 60
25XHBA	- 20
XHBA	- 15, 20, 25, 30, 50, 150, 200 Φ
35XTCA	- 35
38XM Ю A**	- 40, 55, 65, 70, 80, 90, 100, 150 Φ
Ф **	- 10, 15, 20, 25, 30, 40, 50, 60 Φ
ГФ **	- 8, 10, 18, 20, 25, 30, 35, 40, 45, 50, 55 Φ
ЭИ **62	- 8 = 100

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Table No 13-35

Soviet Specifications for Heat Treatment of Special Steel Material

Symbol	Annealing temperature	Hardness (Brinell) after annealing	Forging temperature
У7А	680 - 720	< 187	1050 - 800
У8А	"	"	"
У9А	"	< 192	"
У10А	"	< 197	1000 - 800
У12А	"	< 207	"
38ХА	"	< 207	
45Х		< 227	
12ХН3А		< 217	
12Х2Н4А		< 269	
20Х2Н4А		"	
СТ30ХН3		< 241	
25ХНВА		< 277	
18ХНВА		< 269	
Э**N262	870 - 900	< 250	
СХ8		< 286	
37ХС		< 255	
[illegible] **	680 - 720	217 - 179	1000 - 800
Х12	780 - 800 800 - 870	269 - 217	1000 - 850
Х	770 - 790	229 - 187	1050 - 800
ХГ **	780 - 800	241 - 197	1000 - 800

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Table No 13-36

Chemical Composition of Alloy

Type of steel	Symbol	C	Si	S	P	Ni	
Cr steel	X12	2.00 - 2.30	≤ 0.40	-	-	-	
	XГ	1.30 - 1.50	≤ 0.35	-	-	-	
	7X3	0.60 - 0.75	"	-	-	-	
W steel	B1	1.05 - 1.25	"	-	-	-	(
	B2	1.10 - 1.25	"	-	-	-	
Cr - W steel	3XB8	0.30 - 0.40	"	-	-	-	
	XB5	1.25 - 1.50	≤ 0.30	-	-	-	
	4XBC	0.35 - 0.44	0.60 - 0.90	-	-	-	
	6XBC	0.55 - 0.65	0.50 - 0.80	-	-	-	
	9XBГ	0.85 - 0.95	0.15 - 0.35	-	-	-	
	5XBГ	0.55 - 0.70	"	-			
XXX High speed steel YS	PK5	0.65 - 0.77	≤ 0.40	≤ 0.03	≤ 0.03	≤ 0.02	1
	PΦ1	0.70 - 0.30	"	"	"	≤ 0.4	1
H. SS	P18	0.70 - 0.8	"	"	"	"	1
	P9	0.85 - 0.95	"	"	"	"	

Table No 13-36

Chemical Composition of Alloy Tool Steel

Type of steel	Symbol	Chemical Composition										
		C	Si	S	P	Ni	W	Cr	V	Co	Mo	Mn
Cr steel	X12	2.00 - 2.30	≤ 0.40	-	-	-	-	11.5 - 13.0	-	-	-	≤ 0.35
	XΓ	1.30 - 1.50	≤ 0.35	-	-	-	-	1.30 - 1.60	-	-	-	0.45 - 0.70
	7X3	0.60 - 0.75	"	-	-	-	-	3.20 - 3.80	-	-	-	0.20 - 0.40
W steel	B1	1.05 - 1.25	"	-	-	-	0.50 - 1.20	0.10 - 0.30	0.15 - 0.30	-	-	"
	B2	1.10 - 1.25	"	-	-	-	1.50 - 2.20	"	-	-	-	"
Cr - W steel	3XB8	0.30 - 0.40	"	-	-	-	7.50 - 9.00	2.20 - 2.70	0.20 - 0.50	-	-	"
	XB5	1.25 - 1.50	≤ 0.30	-	-	-	4.50 - 5.50	0.40 - 0.70	0.15 - 0.30	-	-	≤ 0.30
	4XBC	0.35 - 0.44	0.60 - 0.90	-	-	-	2.00 - 2.50	1.00 - 1.30	-	-	-	0.20 - 0.40
	5XBC	0.55 - 0.65	0.50 - 0.80	-	-	-	2.20 - 2.70	"	-	-	-	"
	9XBΓ	0.85 - 0.95	0.15 - 0.35	-	-	-	0.50 - 0.80	0.50 - 0.80	-	-	-	0.90 - 1.20
	5XBΓ	0.55 - 0.70	"	-			"	"				"
XXX High speed steel YS	PK5	0.65 - 0.77	≤ 0.40	≤ 0.03	≤ 0.03	≤ 0.02	17.0 - 18.5	3.6 - 4.5	1.0 - 1.4	4.5 - 5.5	0.3 - 0.6	≤ 0.40
	PΦ1	0.70 - 0.80	"	"	"	≤ 0.4	17.5 - 19.0	3.8 - 4.6	"	-	≤ 0.3	"
H. SS	PT8	0.70 - 0.8	"	"	"	"	17.5 - 19.0	3.8 - 4.4	"	-	-	"
	P9	0.85 - 0.95	"	"	"	"	8.5 - 10.0	"	2.0 - 2.6	-	-	"

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Table No 13-37

Chemical Composition of Structural Alloy Steel

Type of steel	Symbol	Chemical Composition (%)							
		C	Si	Mn	Cr	Ni	P (max)	S (max)	Mo
Cr Steel	ST 15X	0.12 - 0.20	0.17 - 0.37	0.30 - 0.60	0.70 - 1.00	< 0.40	0.04	0.04	
	20X	0.15 - 0.25	"	0.50 - 0.80	"	"	"	"	
	30X	0.25 - 0.35	"	"	0.80 - 1.10	"	"	"	
	35X	0.30 - 0.40	"	"	"	"	"	"	
	40X	0.35 - 0.45	"	"	"	"	"	"	
Cr-Ni Steel	SAE3115	0.10 - 0.20	0.25 - 0.35	0.40 - 0.60	0.55 - 0.75	1.10 - 1.40	"	"	
	" 3120	0.15 - 0.25	"	0.60 - 0.80	"	"	"	"	
	" 3130	0.25 - 0.35	"	"	"	"	"	"	
	" 3135	0.30 - 0.40	"	"	"	"	"	"	
	" 3140	0.35 - 0.45	"	0.70 - 0.90	"	"	"	"	
Cr-Mo Steel	" 4115	0.10 - 0.20	"	"	0.40 - 0.60		"	"	0.20 - 0.30
	" 4120	0.15 - 0.25	"	"	"		"	"	"
	" 4130	0.25 - 0.35	"	0.40 - 0.60	0.80 - 1.10		"	"	0.15 - 0.25
	" 4135	0.30 - 0.40	"	0.70 - 0.90	"		"	"	"
	" 4140	0.35 - 0.45	"	0.75 - 1.00	"		"	"	"
Mo Steel	" 4020	0.15 - 0.25	"	0.70 - 0.90			"	"	0.20 - 0.30
	" 4030	0.25 - 0.35	"	"			"	"	"
	" 4035	0.30 - 0.40	"	"			"	"	"
	" 4040	0.35 - 0.45	"	"			"	"	"
Cr Stainless Steel	II Ж 1	< 0.15	< 0.70	< 0.50	13.0 - 15.0	< 0.6	0.03	0.02	
	II Ж 2	0.13 - 0.23	"	"	"	"	"	"	
Cr-Ni Stainless Steel	II Я 1	< 0.14	< 0.80	0.30 - 0.70	17.0 - 19.0	8.0 - 9.5	"	"	
	II Я 2	0.15 - 0.26	"	"	"	"	"	"	
Cr-Si Stainless Steel	CX 8	0.35 - 0.50	2.2 - 3.2	"	8.0 - 9.5		"	"	
Si-Mn Stainless Steel	SAE9250	0.45 - 0.55	1.80 - 2.20	0.60 - 0.90			"	"	
	" 9260	0.55 - 0.65	"	"			"	"	
Ball Bearing Steel	IIIX 6	0.95 - 1.10	0.15 - 0.35	0.20 - 0.40	< 0.45 - 0.75	0.2	0.27	0.02	
	IIIX 9	"	"	"	< 0.75 - 1.05	"	"	"	
Ball Bearing Steel	" 12	"	"	"	< 1.05 - 1.40	"	"	"	
	" 15	"	"	"	< 1.30 - 1.55	"	"	"	

Table No 13-38

Specification of Ferrotungsten

Number	C	W	Mn	Si	S	P	Specific gravity	Remarks
No 1	0.5 - 1.5	75 - 80	0.5 - 1.5	< 0.3	< 0.1	< 0.03	16.0 - 17.0	
No 2	"	70 - 75	"	"	0.1	< 0.03	15.3 - 16.0	

Table No 13-39

Specification of Ferromolybdenum

Number	C	Mo	Mn	Si	S	P	Specific gravity	Remarks
No 1	3 - 4	50 - 60	< 10	4 - 6	< 0.1	0.05 - 0.15	8.8 - 9.10	
No 2	"	40 - 50	"	"	"	"	8.5 - 8.9	

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Table No 13-40

Personnel Distribution in the Rolling Mill
(First Half of 1953)

Position / Dept or Workshop	Superintendent	Assistant superintendent	Clerks	Engineer	Technicians	Skilled Workers	Ordinary Workers	Apprentices	Total
Management	1	1	5	1	6	8	24	Some	46
Medium bar mill						30	54	"	84
Small bar mill						33	57	"	90
Special steel rolling mill						27	39	"	66
Total	1	1	5	1	6	98	174		286

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Table No 13-41

Personnel Distribution and Work Assignment in the Rolling Mill

Office or Workshop	Position or Section	Responsibilities	Team or Type of Work	No of Pers Per Shift	No of Pers for Three Shifts
Superintendent's Office	Superintendent Assistant superintendent	The entire rolling department		2	2
	Engineer	The technical department		1	1
	Technicians	Designing and workshop technique	Workshop team Planning team	1 3	3 3
	Clerks	Office work		5	5
	Machinery section	Grooving, maintenance of machinery and crane operation	Crane operation and others grooving	2 8	6 8
	Electricity section	Maintenance of electrial facilities		1	3
	Transportation section	Transportation of raw materials and finished products		15	15
Medium bar mill	Furnace operation sec	Operation of the heating furnace		5	15
	Roll operation sec	Rolling and cutting	Cutting team Rolling team	4 9	12 27
	Maintenance sec	Transportation and arrangement of ingots and billets		10	30
Small bar mill	Furnace operation sec	Operation of the heating furnace		4	12
	Roll operation sec	Rolling and cutting		12	36
	Maintenance sec	Transportation and arrangement of ingots and billets		12	36

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Table No 13-41 (Cont'd)

Office or Workshop	Position or Section	Responsibilities	Team or Type of Work	No of Pers Per Shift	No of Pers for Three Shifts
Special steel rolling mill	Furnace operation sec	Operation of the heating furnace		4	12
	Roll operation sec	Operation of roll		10	30
	Maintenance sec	Cutting and arrangement of products		8	24
Working Conditions	Average rate of attendance: 96 per cent. There were no sickness because the shops were very sanitary.				

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Table No 13-42

Output of the Rolling Mill
(Latter Half of 1952 to First Half of 1953)

Roll	Daily Output	Monthly Output	Annual Output	Remarks
Medium Roll	120 tons	3,500 tons	40,000 tons	The actual number of days in operation in a year — 345 (Sundays were regular work days, but the mill was closed on national holidays and on days of electrical repair.)
Small Roll	70 tons	1,800 tons	20,000 tons	
Special Steel Roll	30 tons	800 tons	7,300 tons	

Note: That portion of the medium roll's finished products (billets) which cannot be taken care of in the subsequent process (small roll) is being sold to small factories in the Shanghai area as raw materials.

Table No 13-43

Principal Equipment in the Forging Plant
(May 1953)

Equipment	No	Type	Capacity	Country manufactured
Steam Hammer	Two	Double frame type	Two tons	JAPAN (?) (TN Sic.)
" "	Three	" " "	One ton	" " "
" "	"	" " "	0.5 ton	" " "
Remarks	A five ton steam hammer was being installed after May 1953. It was scheduled for completion for some time in late 1954.			

Table No 13-44

Number of Workers in the Forging Plant
(May 1953)

Position / Dept or Workshop	Superintendent	Assistant Superintendent	Clerks	Engineer	Technicians	Skilled Workers	Ordinary Workers	Apprentices	Total
Administration	1	1	3	(Concurrent) 1	5	3	17	Some	30
Surface scraping section						3	75	"	78
Two-ton hammer section						12	42	"	54
One-ton hammer section						9	66	"	75
½-ton hammer section						6	24	"	30
Maintenance section							45	"	45
Total	1	1	3	(Concurrent) 1	5	33	269	"	312

Note: The superintendent holds the additional post of engineer.

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Table No 13-45

Personnel Distribution and Work Assignment in the Forging Plant
(May 1953)

Position or Workshop	Work Assignment	Name of Teams or Nature of Work	No of Pers Per Shift	No of Pers for All Three Shifts
Superintendent's Office	Superintendent and assistant superintendent		2	2
	Technicians	Assistants to the superintendent and workshop supervision	2 1	2 3
	Clerks		5	15
	Boiler personnel		3	3
	Workers in charge of machinery and electricity		1	1
	Ingot surface scraping and Grinding	Lathe team Grinder team	13 13	39 39
Two-ton hammer sec	Heating and forging involved in the operation of the two-ton hammer	Furnace operation team Hammer team No 1 Hammer team No 2	3 8 7	9 24 21
One-ton hammer sec	Heating and forging involved in the operation of the one-ton hammer	Furnace operation team Hammer teams No 1 - No 3	5 20	15 60
$\frac{1}{2}$-ton hammer sec	Heating and forging involved in the operation of the $\frac{1}{2}$-ton hammer	Furnace operation teams (Two Furnaces) Hammer team	3 5	9 15
Maintenance sec	Arrangement of ingots and billets		15	45
Working conditions	The attendance rate averaged 93 per cent. However, it dropped down to 80 per cent in Summer. Since the work was heavy, a great number of the ordinary workers often failed to report to work.			

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Table No 13-46

Distribution of Workers in the Superintendent's Office
of the Machinery Plant
(May 1953)

Job classification		Duties	Number	Total
Superintendent	Regular	Full responsibility over the plant	1	3
	Assistant		2	
Engineers		Full responsibility over technical matters	2	2
Technicians		Technical assistance	4	12
		Technical responsibility in the workshop	8 (two shifts)	
Clerical workers		Administrative work	15	15
Inspectors		Inspection of finished products	7	7
Electricians		In charge of electricity in the plant	2 (two shifts)	2
Total				41

Table No 13-47

Distribution of Workers in the Wheel Chill-casting Shop
(May 1953)

Job classification		Duties	Number	Total
Foreman	Regular	Full responsibility over the shop	1	2
	Assistant		1	
Cupola section		Operation of cupolas	8	8
Molding section		Molding and casting work	32	64 (two shifts)
Drying section		Operation of drying furnace	4	12 (three shifts)
Maintenance section		Operation of cranes and annealing furnaces and maintenance of sand and metal mold and finished products	20	40 (two shifts)
Clerical workers		Clerical work	2	2
Total				128

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Table No 13-48

Distribution of Workers in the Boilermaking Shop
(May 1953)

Job classification	Duties	Number
Foreman	Full responsibility over the shop	1
Boiler manufacturing section	Boiler manufacturing	25
Machine-processing section	Machine-processing	12
Maintenance section	Maintenance of the plant	5
Clerical workers		1
Total		44

Table No 13-49

Distribution of Workers in the Machine-tool Shop
(May 1953)

Job classification		Duties	Number	Total
Foreman	Regular	Full responsibility over the shop	1	3
	Assistant		2	
Clerical workers			4	4
Large machine-tool section		Large machine-tools	25	50 (two shifts)
Small machine-tool section		Small machine-tools	110	220 (two shifts)
Finishing section		Finishing work	30	30
Maintenance section		Maintenance of machinery and materials	30	30
Total				337

Table No 13-50

Distribution of Workers in the Smithy
(May 1953)

Job classification	Duties	Number
Foreman	Full responsibility over the smithy	1
Clerical workers		2
Air hammer section	Hammering work	18
Forging section	Hand work	12
Maintenance section	Operation of cranes and maintenance of materials and finished products	5
Total		38

Table No 13-51

Distribution of Workers in the Foundry
(May 1953)

Job classification	Duties	Number	Total
Foreman	Full responsibility over the foundry	1	1
Clerical workers		2	2
Melting section	Melting work	7	7
Molding section	Mold making and teeming	20	40 (two shifts)
Sand removing section	Removing sand from castings	6	6
Drying section	Drying sand mold	2	6 (three shifts)
Maintenance section	Maintenance of the foundry	8	8
Total			70

Table No 13-52

Principal Equipment of the Powdered Metal Alloy Plant
(May 1953)

Classification / Names of furnaces	Name and shape	Number	Capacity
Reducing furnace	Heat-resisting steel pipe; tubular type, hydrogen gas reducing furnace	4	Capacity for $WO_3 \longrightarrow W$ 1.5 kg a day (one furnace) 6 kg (eight hours)(four furnaces) 150 kg a month Two tons a year
Sintering furnace	Carbon granule resistance heating furnace (kryptol furnace) 150-kw transformer attached	1	Sintering and molding capacity for WC + CO over 25 kg a day (eight hours) over one ton a month

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